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CHEMICAL AGE

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MAKING WASTES PAY

AVOIDING air and stream pollution by wastes from chemical processing is taxing the chemical engineer even more than the design of new plant or efficient production. Recently there has been considerable stress on new waste disposal processes in the US and some of these are reviewed below. Unfortunately, information on similar work in this country is not so readily available.

Much attention was paid to the problem of radioisotopes waste at the recent Geneva conference on the Peaceful Uses of Atomic Energy. According to research workers at the University of Michigan, however, radioactive waste products of nuclear power reactors could be used in water intake and sewage treatment plants to effect a 99 per cent reduction in harmful bacteria and at the same time lower plant operational costs. According to the Michigan research, harmful bacteria could be killed by running water or sewage past a core of radioactive waste products. The core would act in a similar manner to a huge X-ray machine. Because of the nature of the radioactive waste products and by the use of suitably designed installations, the water and material in the water would not become radioactive, it is stated. The core would remain active for several years. Basic cost of the radioactive waste products would be in the handling of them between the source and treatment centre.

Obtaining a net profit from treating wastes should always be the aim. A New York engineering company claim that stream pollution from waste pickle liquor can be prevented and a net profit obtained. The process operates at a profit when 100,000 gall. a day of waste pickle liquor are handled. Total operating cost, including depreciation, are reported to be less than the values of recovered sulphuric acid (at about £7 a ton) and iron oxide (at about £3 a ton). Cost of the investment is \$2.1 million (about £700,000).

The process involves evaporation and crystallisation to recover acid content of spent liquor and produce ferrous sulphate monohydrate; roasting the latter to ferric oxide and sulphur dioxide; and a contact unit to convert the sulphur dioxide to sulphuric acid. Patents have been filed for the first stage of the process, which involves a two-stage, low-temperature, low-pressure system (180°F, 6.3 p.s.i.a., and 130°F, 1.9 p.s.i.a.) for crystallising the monohydrate under relatively mild corrosive conditions with high thermal economy (*Chem. Engng.*, 1958, **67**, No. 18, 55).

Nitric acid producers in the US appear to have taken to catalytic reduction of air-polluting nitrogen oxides to nitrogen. In this operation, flameless combustion of a gaseous fuel occurs over a platinum catalyst, with the nitrogen oxides supplying part of the necessary oxygen, nitrogen, carbon dioxide and water vapour form. The catalyst is made of crimped nickel ribbon plated with a platinum alloy.

This process was developed by Catalytic Combustion Ltd., Detroit, US, and is now in use by such US nitric acid producers as Texas Co., Allied Chemical US Steel, St. Paul Ammonia Products, and Koppers. Cost of investment is stated to be about \$2 to \$3/s.c.f.m. of waste gas.

Sulphite pulp producers are very much concerned with prevention of river pollution and recovering valuable chemicals for re-use. The most

recent process in the sulphite pulp field is that of Brown Co., Berlin N.H., US, who have invested \$5.25 million to convert their 400 ton/day Burgess sulphite mill to magnesia-base pulping and chemical recovery. The flow of waste pulping solids has been cut off and by integrated processing of the waste, the company recover for reuse 80 to 85 per cent of the magnesia and and 90 per cent of the sulphur. At the same time the operations involved produce 160,000 lb./hr. of 450 p.s.i. steam (ultimately 850 p.s.i. after installation of turbine).

In this recovery process successful combustion of the organic waste liberates heat for pyrolysis of the inorganic pulping chemicals and for production of large quantities of valuable by-product steam. Pyrolysis products are converted back to fresh magnesia bisulphite pulping liquor.

Magnesium bisulphite lends itself to recovery since the waste pulping liquor can be concentrated readily by evaporation. In the recovery furnace it burns to gas containing SO_2 and finely suspended MgO . After separation from the gas the MgO is slaked to Mg(OH)_2 . The slurry then contacts flue gas to absorb SO_2 forming fresh magnesium bisulphite liquor.

In the new installations concentration of waste liquor takes place in a six-effect Sandvik-Ramen evaporator. The recovery furnace, by Babcock and Wilcox, is stated to be the largest single unit built for magnesia recovery. It features vertical design to conserve space and recovers more heat than previous furnaces. The absorption system is understood to be the first to use the Pease-Anthony venturi scrubber for recovering SO_2 gas from flue gas.

The evaporator removes 200,000 lb./hr. of water from

red liquor. It features a dual construction, external flat plate heat exchangers and special sealless circulating pumps which favour high-rate liquor circulation to reduce scaling (due to calcium). In pressure heaters at a temperature of 140°F , fine suspended calcium sulphate crystals are precipitated.

The Babcock and Wilcox recovery furnace has no smelting zone, hearth or dissolving tank as the red liquor burns completely in suspension. All heat of combustion not used to evaporate water is recovered by the boiler (16,000 lb. of steam for each ton of pulp produced). The gases from the combustion zone and superheater are cooled rapidly so that there is little or no conversion of SO_2 to SO_3 .

Cool gas containing 1 per cent of SO_2 flows through two venturi absorbers in series followed by an absorption tower. At each of three absorption stations Mg(OH)_2 slurry reacts with SO_2 to form $\text{Mg(HSO}_3)_2$. By splitting absorption into three stages, pH is controlled at 5.7, thus optimising formation of magnesium bisulphite. A high recirculation rate for the slurry favours rapid change of Mg(OH)_2 through the monosulphite form to bisulphite.

Weak acid from the first venturi absorption stages enters a settling tank where suspended calcium and silica solids settle out. The clear acid then passes to an acid cooler where free SO_2 content (H_2SO_3) is built up. The raw $\text{Mg(HSO}_3)_2$ H_2SO_3 passes through precoated, porous stone filters to remove any traces of carbon from the recovery furnace. The clear acid is then pumped to storage tanks to be further strengthened by digester relief gases. The acid is used for digesting wood chips to produce pulp.

GERMANY'S 'COLD' RUBBER PLANT

THE promises of financial support and a certain amount of tax relief made by the Government of West Germany to Bunawerke Hüls in connection with the new synthetic rubber plant at Marl have not yet been fulfilled. Professor Dr. h.c. P. Baumann, a director of Bunawerke, at the opening of the new plant (see last week's *CHEMICAL AGE*, p. 481) maintained that in other countries, such as the US and more recently Italy and Japan, synthetic rubber companies had been given great help in the building and operation of their plants by the Governments concerned.

The company would, therefore, have to plan carefully if it were to meet the strong competition from the much larger plants in the US and still be able to finance the necessary research into the further development of the product and the processes of manufacture.

As stated last week, the plant is working at less than half the capacity of 45,000 tons. Output is being restricted because it is not known whether the German fabricating industry, which is importing rubber under long-term contracts, can absorb more. This low rate of production may mean that the plant will operate at a loss for the next year or two.

The total investment in butadiene production and concentration, the polymer plant and storage facilities for intermediate and finished products amounted to DM114 million (£9 million). Plant erected by Chemische Werke Hüls in connection with the synthetic rubber project cost about DM36 million (£3 million). The total of DM180 million compares with a share capital of DM42 million (£3½ million). Two-thirds of the fixed assets had to be financed through medium- and long-term loans by the four firms behind the venture, chiefly by Chemische Werke Hüls, and the revolving capital will presumably be provided largely by the banks.

Another disappointment has been the fall in rubber prices, from DM2.80 per kg. in West Germany when it was decided

to erect the new facilities, to DM2.45 now. As the present output corresponds to about one-quarter of domestic needs, full operation would depend on either the bulk of West German consumption being met by the Marl plant, or else substantial tonnages being sold abroad. In the foreign market, however, increasing supplies will become available with the new capacities being commissioned in other European countries. It is also possible that Buna rubber from Schkopau in East Germany may be shipped to western markets, when eastern bloc needs can be met from other sources.

On the other hand, West German rubber fabricators have undertaken to bear part of the financial risk in the first five years of plant operation. The West German Government's refusal to provide either direct finance or a guarantee to other potential creditors, has entailed special legal arrangements being made as regards the coverage of financial losses.

In view of these considerations, the risks taken by the four chemical firms behind the project is considerable. Doubtless, further development will figure high in future costs. The position is clearly far from healthy, but there is no doubt that from the long-term point of view, prospects for the new plant are good.

The synthetic rubber production of the world is now about 1.8 million tons a year, only about 400,000 tons below the natural rubber figure, which is unlikely to increase. The future obviously lies in the hands of the synthetic rubber producers. The development of the world rubber market since 1945 shows that the demand for rubber could be satisfied only if there was a considerable increase in volume in the manufacture of synthetic compounds. Excluding the Communist bloc countries, the world demand for rubber has risen in the past 10 years by 1.8 million tons a year to the present total of 3½ million. In 1947, natural rubber could handle about 72 per cent of demand; this percentage has shrunk to about 57 per cent.

UK PLASTICS PRODUCERS MAY SWITCH FROM ACETYLENE TO ETHYLENE

New Polymers will Dominate Expanding Industry

A FIVE-FOLD increase in UK production of plastics materials in the next 25 years—with a third of production in 1983 being accounted for by materials now in the laboratory stage—was forecast at the silver jubilee conference of the British Plastics Federation, held at Torquay this week. Among new materials being developed in the UK, it was stated, is polypropylene.

When the Federation was formed in 1933, production was 20,000 tons, compared with 393,000 tons last year. Dr. H. M. Stanley (Distillers Co. Ltd.), in a paper to be read on 25 September, estimated that by 1965 annual production would exceed 750,000 tons. Mr. H. A. Collinson (Leicester, Lovell and Co. Ltd., Southampton), in a paper to be read the same day, forecast that UK production in 1983 would be more than 2 million tons, a five-fold increase since last year.

Raw material bases of the UK plastics industry were reviewed by Dr. Stanley particularly from the viewpoint of competition from other producing countries. He also gave some indication of the changes in raw material requirements likely to develop in the immediate future as a result of expansion and the introduction of new plastics materials. The term 'plastics' was used in its broadest sense and covered the whole range of synthetic polymer organic materials.

Total Production

Total output of thermosetting and thermoplastic materials (excluding fibres and rubbers) had grown from below 200,000 tons per annum in 1950 to nearly 400,000 tons in 1957. The growth rate had been much greater for thermoplastics, which had increased from about 50,000 tons in 1950 to about 230,000 tons per annum in 1957 whereas thermosetting materials had only increased from just over 100,000 tons in 1950 to about 170,000 tons per annum in 1957. The growth rates of polythene and polyvinylchloride had been strikingly rapid.

Production of synthetic rubber-like polymers had been small to date, but when the new Fawley plant of the International Synthetic Rubber Co. is in full operation, the production of rubbery butadiene copolymers in the UK should attain more than 70,000 tons per annum; most of this would be GR-S.

Of the large amounts of auxiliary chemical materials such as plasticisers, stabilisers, catalysts, etc. used, plasticiser esters (mainly phthalates) were particularly important, and probably amounted to upwards of 30,000 tons per annum at the present time.

Since the basic skeletal structural

	1954	1955	1956	1957
Thermosetting Materials				
Alkyds	34,000	36,000	40,000	44,000
Aminoplasts (moulding powder and resins) ...	36,000	39,000	41,000	42,000
Casein plastics	2,100	2,700	2,700	1,700
Epoxy resins			72,000	
Phenolics (moulding powder and resins) ...			45,000	44,000
Polyesters	400	900	2,200	3,200
Thermoplastic Materials				
Cellulosics (moulding powder)	11,200	11,900	11,400	12,200
Polyacrylates and methacrylates		10,000	11,000	15,000
Polythene	20,000	20-35,000	45,000	55,000
Polystyrene	21,000	21,000	23,000	29,000
Polyvinyl acetate			11,000	12,000
Polyvinyl chloride and copolymers	41,500	47,000	57,000	68,000
Fibres				
Cellulose acetate	29,900	30,400	31,300	26,300
Nylon	10,300	13,800	15,600	(20,000)
Terylene	400	2,700	5,800	(10,000)
Others	2,300	1,800	1,300	—

TABLE I
UK Production of Plastics and Fibres (Tons per annum)

material was carbon, plastics could justly be regarded as forming part (and a very large part) of the UK organic chemical industry.

Among the most important chemicals and intermediates being produced (or shortly to be produced) from petroleum were ethanol, isopropanol (for acetone), ethylene oxide (and thence ethylene glycol), ethylene (for polythene), styrene, butadiene, oxo higher alcohols.

Reference was made to the growing importance as a chemical raw material of natural gas in Italy, Rumania and France. It was particularly interesting as a raw material for making acetylene by a combustion-type process in an integrated plant in which the by-product gases are used in the formation of ammonia or methanol. It remained to be seen whether processes of this kind would permit the continued use of acetylene as a chemical raw material (or even an expansion in its use) in those countries which were blessed with cheap natural gas, remarked Dr. Stanley.

From information available on the production of individual plastics and allied materials, Dr. Stanley gave approximate figures calculated for the consumption of the various intermediate chemicals needed.

It was clear from Table 2 that most of the intermediates needed for the production of thermosetting materials were ultimately derived from coal and its products of carbonisation. The more rapidly expanding thermoplastic materials and synthetic rubbers, however, were largely based on petroleum hydrocarbons.

The requisite raw materials were available in adequate quantities and at inter-

TABLE 2
Approximate Consumption of Intermediates (UK 1957-58)

Intermediate	T/A Approx. quantity
Phenol	16,000
Phenol homologues	16,500
Urea	25,000
Methanol (for formaldehyde)	30,000
Phthalic anhydride	18,000
ex 36,000 t/a naphthalene	12,000
Acetylene	28,000
(Carbide equivalent)	93,000
Benzene	25,000
Ethylene	65,000
Acetic acid and anhydride (as acetic acid)	38,000
Acetone	11,000
Butadiene	60-65,000
p-Xylene (for terephthalic acid)	8,000

nationally competitive price levels. This was particularly so in the field of petrochemicals when the scale of UK manu-

Dr. Stanley Predicts that—

- Established thermosetting materials likely to hold position; modest expansion likely over next few years.
- Cellulosic plastics and fibres to remain static; some increase in newer derivatives e.g., triacetate fibre.
- Thermoplastics, particularly polythene and p.v.c. polymers, will grow rapidly, polystyrene and copolymers steadily, but at lower rate.
- New thermoplastics (polypropylene, polyolefin copolymers) and polyacrylonitrile for fibres will be introduced.
- Nylon and Terylene production to continue steady growth; 1960 capacity likely to be 30,000 tons a year for nylon and 25,000 tons for Terylene; acrylonitrile based fibre to be about 10,000 tons a year.
- Greatest potentialities for expansion in synthetic rubber-like materials.

facture was large enough to provide economical operation and the basic raw material was abundantly available at price levels which were reasonably stable and uniform over large areas of the world, and particularly Western Europe.

In assessing figures for UK rubber consumption it was pointed out that the usage of synthetic rubbers in the country had been limited by the fact that they had all had to be imported from hard currency areas.

TABLE 3
UK Rubber Consumption
(Tons per annum)

	1953	1956	1957
Natural	219,600	192,800	181,600
Synthetic	4,900	39,500	54,400
Total	224,500	232,300	236,000
Individual synthetics:			
S-type	900	26,500	42,600
Neoprene	2,300	4,100	4,800
Butyl	400	6,300	7,600
N-type	1,300	2,800	2,400

On a world-wide basis, total consumption of rubber and rubber-like materials was expected to increase by around 1,000,000 tons per annum in the period up to 1965. Since natural rubber production was unlikely to increase substantially in this period, it appeared certain that a large increase in synthetic rubber production had to take place in all the major industrial countries. In this country a good start had been made in the new Fawley factory of the International Synthetic Rubber Co. with a capacity of about 65,000 tons per annum of GR-S and the recent announcement of Du Pont's intention to produce 20,000 tons per annum of neoprene on the basis of acetylene in N. Ireland. Another important synthetic rubber was butyl rubber, while other newer types, based on the polymerisation of isoprene and of ethylene-propylene mixtures were under development abroad. The new German polyurethane rubbers based on propylene oxide polymers might also become important in this country.

On the basis of the above trends Mr. Stanley considered it likely that the production of thermoplastic materials (including rubbers and fibres) in the UK in the next five to seven years, say by 1965, would attain a figure of perhaps 500,000 tons per annum, making a total production of both thermosetting and thermoplastic products of upwards of three-quarters of a million tons per annum. The figure for thermoplastics might include therefore: (a) Based essentially on petroleum hydrocarbons—Polyolefins and synthetic rubbers (excluding chloroprene rubbers) in quantities of several hundred thousand tons per annum. (b) Based primarily on acetylene—Vinyl chloride and vinyl acetate polymers and copolymers, as well as chloroprene rubbers and acrylonitrile fibre-forming polymers, the total material in this category being perhaps as high as 200,000 tons per annum. (c) Based primarily on aromatic hydrocarbons—Polystyrene, nylon and Terylene, the total quantity being probably of the order of 100,000 tons per annum.

Acetylene needed for the postulated increase in the production of these plastics materials enumerated in category (b) above could, in principle at least, be simply supplied by increasing carbide capacity or by cracking suitable petroleum fractions either thermally or oxidatively by one or other of the new acetylene processes now under development. It seemed likely, however, that much of these expansions would not be based on acetylene, at any rate in the UK, but most probably on ethylene.

Difficulties were most likely to arise in the more distant future in regard to the supply of aromatic hydrocarbons, particularly benzene and naphthalene, which would be required in the contemplated expansion in category (c) materials, and in the provision of additional plasticiser esters, especially for p.v.c. The position in regard to these hydrocarbons was as follows:

Benzene: Production of pure benzene from the most suitable raw material, namely coke oven benzole, had increased rapidly from 65,000 tons per annum in 1953 to 126,000 tons per annum in 1957. The ultimate capacity of UK coke ovens at present levels of steel production was somewhat difficult to assess, but was probably in the region of 180,000 to 200,000 tons per annum with additional material perhaps 50,000 tons per annum available from gas works benzole, though probably at higher purification cost. Mr. Stanley believed that the annual consumption of benzene in the plastics and associated industries by 1965 would increase by something like 50,000 tons per annum. This fact, taken in conjunction with an appreciable increase in benzene usage for other chemical purposes (e.g. insecticide, detergents) would mean that supplies of home-produced benzene would tend to become inadequate at some time in the not-too-distant future, probably in the period 1965-1970. In the long run petroleum would probably be a source of benzene to augment benzene supplies from coal carbonisation, but the economics of the production from petroleum are by no means clear at the moment.

Naphthalene: Production of white and hot-pressed naphthalene has increased

steadily from 26,000 tons per annum in 1953 to 33,000 tons per annum in 1956; in the latter year an additional 19,000 tons of crude naphthalene were produced. The increased consumption of naphthalene for the plastics industry (phthalic anhydride for plasticiser esters particularly) over the next five to seven years would probably be 10,000 to 15,000 tons per annum, a quantity which should present no great supply difficulty. Total potential production of naphthalene in the UK was probably of the order of 70,000 tons per annum.

It seemed not improbable that important changes would, in the next few years, take place in respect of the raw material bases of a number of individual plastics materials, especially in the thermoplastic and fibre fields. This was most likely to occur in acetylene now largely used in the production of vinyl chloride, vinyl acetate, acrylonitrile and chloroprene. Acetylene from carbide was a relatively expensive starting material and unless much cheaper acetylene could be produced in other ways (e.g. from natural gas in Italy) great efforts would be made to develop new methods of production based on cheaper raw materials.

Substantial quantities of vinyl chloride were now produced from ethylene in the US, and Dr. Stanley anticipated that this tendency would spread to other countries. Vinyl acetate was being produced by a new process, discovered in this country, in which the raw materials were acetaldehyde and acetic anhydride, both of which could be regarded as derivatives of ethylene. In a recently announced new German method of making acrylonitrile, acetaldehyde replaced acetylene as the main raw material and this effectively put acrylonitrile in the category of ethylene-based chemicals. From Russia had come news of the development of a nylon-like material (Nylon 7) which was based on ethylene rather than on benzene or phenol. Competition between one petroleum hydrocarbon and another could be expected. In the US large scale production of acetic acid was by the oxidation of n-butane, which thus competed with ethylene as basic raw material.

New Methods of Polymerising Dominate Plastics Industry, says Mr. Collinson

THE current trend to shorten the time between laboratory and full-scale production was in line with the quickening tempo of industrial life and led to the conclusion that many plastics materials in the laboratories today would be in full scale production in three to four years time. This was the conclusion of Mr. H. A. Collinson (Leicester, Lovell and Co. Ltd., Southampton) in his paper 'The technical future of the plastics industry', that he was to read at the BPF conference on Thursday.

Mr. Collinson in his paper said that looking at the current laboratory activity it could be seen that polymer production

and new methods of polymerising dominated the scene and pointed the way ahead. Natta's isotactic approach made possible such things as isotactic polystyrene with a melting point of 200°C and that type of break-through technique opened new and interesting fields.

Polypropylene was a reality with a higher temperature resistance than polythene and greater rigidity, and made from a raw material that was cheap and plentiful. Also in the experimental stage was chlorinated polyether exhibiting physical characteristics in which no single property stood out over and above

(Continued in p. 524)

NITROGEN MAY BECOME AEROSOL PROPELLANT OF THE FUTURE

NITROGEN is one example of new propellants now being evolved in the UK that could widen the range of products packed in aerosols to include food, or which might prove cheaper than the normal chloro-fluoro-hydrocarbons. This is stated in 'Packaging: Productivity Review 30' (British Productivity Council, 21 Tothill Street, London SW1, 5s), a review of current developments in packaging.

Output of UK aerosols rose from 6.5 million in 1955 to about 9 million in 1957. Sales in the US amount to 300 million a year and manufacturers there are optimistic about the prospects of the aerosol. Future expansion is believed to lie in sauces, syrups, soft drink concentrates and food. It is felt that there is also considerable scope for further development in the UK.

Yearly Spending

Yearly expenditure by UK industry on packages has grown from an estimated £300 million in 1950 to not less than £400 million last year. Big increases in outputs of packaging materials are reported, with production of plastics materials up from 160,000 tons in 1950 to 400,000 tons last year, when home consumption rose by 22 per cent. Consumption of polystyrene for containers all but doubled in 1957. In the same year output of polythene rose by another 40 per cent to 55,000 tons (6,000 in 1952), while imports added a further 5-6,000 tons. One-third was used for moulding (and bottles) and another third as film. Polythene is now said to be second only to regenerated nitro-cellulose as a packaging material. Production of cellulose film has rather more than doubled since 1950. Between 1950 and 1957, fibreboard packing-case makers increased output from 370,000 to 600,000 tons. Some 40 per cent of all UK paper products is used for packaging. In 1955 production of glass containers reached a post-war record of 3,610 million; output in the first quarter of this year was at an annual rate of 4,140 million containers.

Discussing standardisation of steel drums, the report states that the chemical industry is adopting the oil industry standard of an 18-gauge 46-gall. tight-head mild steel drum. Despite this, the spokesman of one large company stated that it still received its industrial chemical supplies in at least six different sizes of 40-50 gall. drum.

Dealing with reconditioning, the report states that one firm with a reconditioning charge of 7s advises customers to budget for five or six trips for an 18/19 gauge drum and eight or nine trips for one of 16/17 gauge as the most economical proposition.

On fibreboard cases and drums, it is stated that UK output in 1957 reached a record of 600,000 tons of which about 40 per cent was in solid board. In the US, however, corrugated board has all but ousted solid board and granular chemicals in amounts of up to a ton are being transported in bulk corrugated cases with built-in fibreboard feet or on pallets.

Fibreboard drums, in up to 10 plies which are generally of kraft and which may include sandwich layers of metal foil, bitumen plastics or may have an inner polythene wall or bag, are used for hygroscopic chemicals. The customer takes the bag and the contents out of the drum which can be returned clean for reuse. Molten products are now being poured directly into specially-protected drums in which they solidify.

Output of paper sacks has risen from 300 million in 1947 to 450 million in 1957. These sacks are said to be about two-thirds the price of similar jute sacks. One large user is quoted as taking 98

per cent of his packaged chemicals and a supplier to export 85 per cent of his in paper sacks. One plant is said to use heat-sealed polythene bags inside paper sacks for relatively expensive products, the moisture content of which must be kept below 0.25 per cent. Sacks may be coated with silicones so that molten compounds at high temperatures, such as bitumen and resin compounds, can be poured in before solidifying. Molten materials at temperatures of up to 425°F have been packed in a special sack. A flame-resistant sack is among new developments.

Production of glass containers quoted at 550 million in 1920 rose to slightly more than 4,000 million in 1957. Glass is said to have a tremendous lead over all the newer materials, partly because of valuable properties such as high chemical durability and stability and non-toxicity.

Breakages in returnable bottles have been cut by as much as 50 per cent by one user spraying each bottle on return for filling with a protective coating of carbon derivatives and silica.

Sales of new jute sacks in 1954 amounted to 240 million (200 million in 1948). Since 1954 the trend has probably been downwards. At present more than 20 different chemical treatments are available for a wide range of special uses.

'Flexible Sausage' Barge On Trial In Southampton Water

FOR MORE than a month a 100 ft. long sausage-shaped flexible rubberised-nylon container loaded with 10,000 gallons of kerosene has been undergoing trials in Southampton water. Towed at speeds up to 5½ knots by a conventional 60 h.p. motor launch, the 'barge'—with less than 20 per cent of its volume showing above water—has so far proved leak-proof, collision-proof and highly manoeuvrable.

And on Tuesday, 30 September, when it makes its last public run in the present series of tests, the oil contents will be discharged in the normal way at a dock-side depot or into a conventional tanker, and the 'barge' rolled up on a reel and carted away on a motor truck.

This prototype container that can handle liquids with a specific gravity less than unity is the product of Dracone Developments Ltd., a company sponsored by the National Research Development Council to exploit the invention of Professor W. R. Hawthorne, F.R.S., Sir Geoffrey Taylor, F.R.S., and Mr. J. C. S. Shaw, M.A., of Cambridge, who conceived the idea in the autumn of 1956.

The Dracone 'barge' was first designed as a trans-ocean vehicle to reduce the shipping costs of oil, but the experiments carried out on the modest 40-tons capacity prototype indicate an equally useful potential for the invention on rivers and canals, and—since the container may be made of a choice of plastics—for the transportation of all lighter-than-water chemicals, whether corrosive or not.

The Dracone prototype was made by P. B. Cow and Co. Ltd., of 5/32 in. woven nylon fabric coated inside and out with synthetic rubber, and it weighs 2,300 lb. Eyes are fitted at nose and stern for towing and mooring ropes, while at there is an Avery-Hardoll self-sealing, quick-acting hose connection for emptying and filling through a 4 in. hose.

The reel used for carrying the barge when it is not in use is 8 ft. long and 5 ft. in diameter. Maximum economical speed of the prototype model—100 ft. long, 5 ft. diameter and carrying 40 tons of oil—proved to be 7 knots, with a drag of only 800 lb. It is calculated that a 300-ft. long model to carry 1,100 tons could travel economically at 12 knots with a drag of 19,000 lb.

Goodyear's First Chemical is Styrenated Phenol

A STYRENATED phenol trade-marked 'Wing Stay S'—described as an anti-oxidant for reducing deterioration due to weathering in natural and synthetic rubbers—is the first chemical to be manufactured by The Goodyear Tyre and Rubber Co. (Gt. Britain) Ltd., Wolverhampton.

'Wing Stay S' is a viscous, almost colourless liquid developed by Goodyear in the US, and its special virtue in the rubber treatment field is that it is non-staining. It is capable of rapid and thorough dispersion in both solid and liquid compounds, and above 25°C it can be added directly to rubber stocks.



★ HIS MANY friends in the chemical industry, in chemistry and agriculture, will be pleased to know that Sir William Ogg is to maintain his life-long interest in agricultural science when he retires next week from the directorship of the Rothamsted Experimental Station. Sir William, who will in future live on his farm in Angus, is to be consultant to Scottish Agricultural Industries Ltd., whose new £3 million fertiliser plant at Leith was opened in March by Sir Alexander Fleck.

After work on explosives during the 1914-18 war, Sir William spent a year in Canada and the US studying methods of soil research and soil survey. This was followed by four years of post-graduate research at Christ's College, Cambridge. While advisory officer in soils at the East of Scotland College of Agriculture in the late 1920's, he prepared a report on land reclamation which led to the foundation of the Macaulay Institute for Soil Research at Aberdeen.

Sir William's world-wide reputation in soil science led to a demand for his services not only in the UK, but from overseas as well. Since the war he has visited the USSR three times and is an hon. member of the All-Union Society of Soil Scientists of the USSR and foreign member of the academies of agriculture of the Soviet Union, France and Sweden.

This summer, Sir William was awarded the Piria Gold Medal of the Italian Chemical Society at the joint meeting held in Turin with the Society of Chemical Industry.

★ PLANNING permission has been granted to Ashburton Chemical Works Ltd. (CA, 20 September, p. 488), a subsidiary of Geigy (Holdings) Ltd., for the building of a chemical factory on a 100-acre site forming part of Glynllifon Park, Caernarvon. The county council has given the permission with the approval of the Ministry of Housing. The county council reports that it is making steady progress with the preparatory work in conjunction with the Gwyfrai Rural Council.

As I have stated before the major hold-up over this project has been due to a clash of expert opinion over water supply. Gwynedd River Board objected to the plan to impound water on the Llynfi River and suggested that water should be taken from Nantlle Lake. Ashburton objected to this as they feared that this would leave suspended matter in the water, requiring costly settling tanks and filtration plant. The company wanted to store settled water at the Craig y Dinas reservoir and pipe it direct to the works.

While the county and Gwyfrai councils are actively pursuing the Craig y

Dinas scheme with the company's approval, the river board has now engaged a water consultant to advise them. Mr. J. E. Owen-Jones, clerk of Caernarvonshire county council, last week said that the company, which was still engaged on the economic planning of the project, was perfectly satisfied with what the two councils were doing and was co-operating happily with them.

★ THE NORWEGIAN wood processing concern, A/S Borregaard, which has developed the production of chemicals from sulphite waste liquor more extensively than any other Scandinavian firm, will this year complete a plant for exploiting the lignin which is residue in the sulphite liquor, together with the sugar. The lignin will now be applied as fuel by a new wet oxidation process and save Borregaard at least 50,000 tons of imported fuel a year. (See CHEMICAL AGE, 13 September, p. 436.)

Known as the Zimmerman process, it was developed on laboratory and pilot plant scale in the US. Borregaard, however, are the first to develop it on a full technical scale and they hold the complete exploitation rights for the pulp and paper industry in Europe.

The company which has mills in Norway, Austria and Sweden, last year produced a total of 300,000 tons of cellulose. Large quantities of chlorine, caustic soda, sulphuric acid and carbon disulphide are being produced at Sarpsborg on a scale sufficient to meet the company's needs and to export the surplus. The 1957 output of inorganic chemicals was 78,000 tons. Waste sulphite liquor is distilled into 96 per cent pure ethyl alcohol at a plant at Sarpsborg said to be the largest of its kind in the world.

★ SHORTLY after the view expressed in 'Distillates' (CA, 13 September, p. 438) that fluorine chemistry has a great potential future, comes a statement from Bell Aircraft of the US that liquid fluorine is a possible replacement for liquid oxygen in liquid-fuel systems. It seems that liquid fluorine as an oxidiser for booster rocket fuel promises to increase rocket payloads by as much as 70 per cent in existing missiles.

Although the advantages of fluorine have been known for some time, engineering difficulties in handling the highly reactive fluid have until now prevented its practical use. Bell state that large-scale test chamber firings show that the use of liquid fluorine (at -306°F) instead of liquid oxygen can add 22-40 per cent to the power output of existing fuels. A conventional fuel mixture such as liquid oxygen and kerosine produces a sea-level thrust of about 245 lb. a second

per lb. of propellant. The use of fluorine could raise this to 300 or 345 lb. per second, according to the base fuel.

The ideal combination would probably be liquid fluorine plus liquid nitrogen. The possibility of working such a system is, however, remote.

★ STATISTICS show that Mexico's chemical industry has grown at a higher rate in recent years than any other field of Mexican industry. There is every promise that the present trend will continue. It is probably this expansion that has prompted the Mexican National Chamber of Chemical Industry to plan a national chemical industry congress to be held at a future date in conjunction with a chemical exhibition in Mexico City.

At present, the chamber lists 56 members who produce basic chemicals, industrial chemical substances, synthetic fibres, plastics, chemicals for agricultural uses, etc. I learn that chemical enterprises established in Mexico represent an investment of 1,240 million pesos (almost US \$100 million). More than 8,600 workers, excluding technical and administrative personnel are employed, and more than 120 chemical substances are produced, some of which are, of course, basic materials, for other chemical products.

★ THE DEVELOPMENT of a package for an exceptionally hygroscopic chemical, with tests carried out for a year before the product was introduced commercially, is among the interesting information given in the British Productivity Council's new report on packaging (see p. 521). The most suitable combination of materials proved to be a wet-strengthened five-ply paper bag with a bitumenised and a polythene-coated wall. This was chosen on grounds of efficiency and price. Storage tests showed that this bag lasted for as long as six months in a variety of atmospheric conditions.

As the bag had to be considered as part of the production line the wet-strengthened kraft paper formed the inner ply to prevent abrasion of the product by the polythene in rapid filling. From a range of closures, an internal sleeve was chosen so that the bags are automatically closed by the weight of their own contents when these are tipped away from the filling spout. Advantages here were speed of operation and economy of labour. Pallets were used to replace slings at the ports and now damage is said never to exceed one half of one per cent.

This is a story of care rewarded. And there are still chemical manufacturers who look on packaging as a job to be foisted on to anyone willing to undertake it!

Alembic

NEW TECHNIQUES & APPARATUS

★ For Process Control and Basic Research

Spekker Absorptiometer

AN adaptation of Spekker absorptiometer was shown with an automatic pipette by P. L. Gibbon and L. Harvey (Research and Development Department, Distillers Co. Ltd.) at a meeting of the SAC biological methods group held earlier this year. This instrument has been adapted in order that a larger number of readings may be made easily and quickly.

A flow-through cell of capacity 10 ml. is used with an overflow device which catches and breaks foam. The sample is fed in by gravity and after measurement is removed by suction (house vacuum). A foot-operated valve, placed between the Spekker cell and a Buchner flask which receives the discarded sample, controls the vacuum.

The foot-operated valve is shown in section in Fig. 1. It is robust and applies simple leverage to open a valve which is shut by a strong spring. The valve is made of stainless steel with a p.t.f.e. seating to resist corrosive cleaning fluids.

In turbidimetric assay the following sequence of operation is adopted: with uninoculated medium in the cell, the absorptiometer is set to maximum reading. The turbidity of a standard series of tubes is measured in turn starting with the least turbid and a standard curve is prepared. The samples are read in a similar way and the concentration is obtained from the standard curve. Two operators work together; No. 1 operates the absorptiometer and No. 2 records and calculates. For convenience, No. 1 measures a group of three tubes of the

same concentration before giving the values to No. 2 who records, averages the figures and reads the significance from the standard curve. No. 1 measures a further group immediately so that both operators are occupied simultaneously.

Both hands are required to operate the

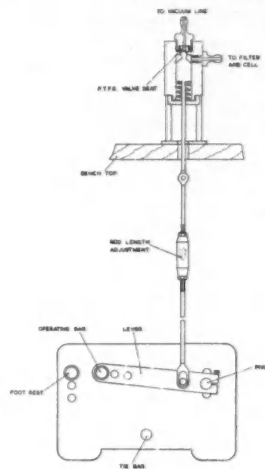


Fig. 1

absorptiometer and while the discarded sample is being removed by suction (foot controlled) the next sample is being mixed prior to filling. Samples are read at the rate of about 100 tubes per hour.

Automatic Pipette for Bioassay

IN bioassay generally and in turbidimetric assay in particular, large numbers of accurately measured aliquot portions are used. For instance, various measured volumes of distilled water are combined with appropriate volumes of sample to give different concentrations for turbidimetric assay; or again, a constant volume of basal medium may be added to each tube of the test, possibly under sterile conditions.

The machine (Fig. 2), also displayed by P. L. Gibbon and L. Harvey, is made of stainless steel except for the special balls in the valves which are made of Hastelloy D. The gland packing is made of p.t.f.e. so that corrosive cleaning fluids may be used. The valve is easily detachable and may be sterilised by heat.

Any one of five volumes (1, 2, 3, 4 or 5 ml.) can be selected by push button, the change being instantaneous.

The pump plunger is operated by a cardioid cam which is driven by a constant speed motor; this gives the pump plunger a constant linear velocity and delivery is cut off instantly.

Delivery at the rate of 45 per minute is made via p.v.c. tubing terminating in a stainless steel nozzle which is moved from tube to tube in the rack. Restriction of the bore of the nozzle together with instant cut-off of delivery eliminates drips between deliveries.

Solutions only are dispensed and precision is of the order of ± 1 per cent at 1.0 ml.

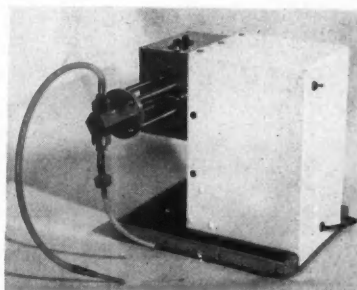


Fig. 2. Automatic pipette

In the rapidly changing world of industrial chemistry, the chemist is often led to devise new methods of approach or to modify existing techniques or apparatus. Many of these ingenious solutions are either never published or published only after long delay.

Ideas which could save other chemists much time and effort are not being fully utilised. To stimulate speedier publication, 'Chemical Age' invites research workers in industry, universities and research organisations to submit brief notes of new work of general interest to industrial chemists and chemical engineers. These can either take the form of original notes or summaries of papers awaiting presentation. Contributions should be sent to: Editor, 'Chemical Age,' 154 Fleet Street, London EC4. Length should be between 200-400 words; where necessary, photographs or drawings should be included.

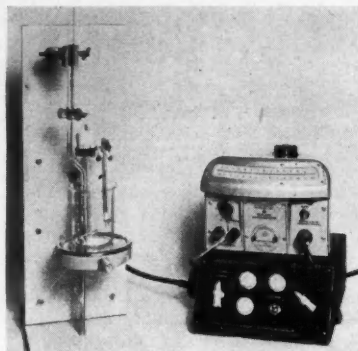
Items published will be paid for at the minimum rate of £3 3s. each.

★
First contributions are featured in this page and the next. A number were the subject of demonstrations at a meeting of the SAC Biological Methods Group held earlier this year.

AMPEROMETRIC TITRATION APPARATUS BY ICI TEAM

SHOWN HERE is an amperometric titration apparatus designed by the ICI Metals Division research department. The instrument is used for the rapid determination of small amounts of chloride in titanium, zirconium and miscellaneous materials by a procedure incorporating a polarisation end-point. The sample solution is titrated with a centinormal solution of silver nitrate using a pair of identical second-order electrodes consisting of two silver wires coated with silver chloride.

A complete description of the apparatus, with recommended analytical procedure which has potentialities for the determination of small amounts of silver, appears in the September issue of *The Analyst*.



At present only three models of the instrument have been made and it is not in commercial production.

Assessing Anti-Inflammatory Drugs

ASSESSMENT of anti-inflammatory drugs was complicated because there were several types of inflammation, stated Dr. G. F. Somers Distillers Co. (Biochemicals) Ltd., Liverpool, at the SAC demonstration meeting. Thus inflammation induced by exposure to ultra-violet light was quite different to the special type of inflammation experienced in rheumatism. The activity of a compound should, therefore, be tested on various types of inflammation and in different species of animals. In choosing an experimental method the observations should be reproducible, the intensity of the reaction should be correlated with the intensity of the stimulus, the response should be measurable and not assessed subjectively, and the results should be suitable for statistical analysis.

The methods presented were (a) in-

hibition of the formation of granulation tissue in cotton pellets implanted in rats (1), (b) inhibition of the tuberculin reaction in B.C.G. infected guinea-pigs (2), (c) inhibition of the swelling of the rat's foot injected with formaldehyde (3) and (d) the granuloma pouch method in rats (4). The methods described were illustrated by results obtained with hydrocortisone and a new anti-inflammatory drug, glycyrrhetic acid, obtained from liquorice. The results confirmed the anti-inflammatory activity of glycyrrhetic acid and show that a drug does not need to have an adrenal-corticoid activity to be an anti-inflammatory agent.

REFERENCES

- (1) Meier, Schuler and Desaulles; *Experimentia*, 1950, 6, 469.
- (2) Long and Mills; *Lancet*, 1950, 1, 492.
- (3) Selye; *Brit. Med. J.*, 1949, 2, 1129.
- (4) Selye; *J. Amer. Med. Ass.*, 1953, 152, 1207.

Simple Tests for Analgesic Drugs

MANY experimental methods had been described for the assessment of analgesic drugs in laboratory animals, but few showed any close relationship to pain experienced in man, said Dr. Somers in another report. Species differences were considerable and individual variations large. Comparisons were usually made between different drugs, thus conflicting with one of the main principles of biological assay; so that it was not surprising that results from different methods did not agree.

The methods presented by Dr. Somers were the hot plate method of Woolfe and Macdonald (1), the tail pinching technique of Haffner (2), the electric grid method of Dodds *et al.* (3), and heat and electrical stimulation of the tail. For the latter the tail of a mouse is immersed in water at 55°C, or stimulated electrically through applied electrodes. In all methods a constant pain stimulus is

applied, the animals are tested in groups at ascending dose levels and the responses assessed quantally.

REFERENCES

- (1) Woolfe and Macdonald; *J. Pharmacol.*, 1944, 80, 300.
- (2) Haffner; *Dtsch. Med. Wschr.*, 1929, 55, 731.
- (3) Dodds, Lawson, Simpson and Williams; *J. Physiol.*, 1945, 104, 47.

Diploma in Technology

First awards of the Diploma in Technology have been made to 34 candidates who have successfully completed an approved four-year sandwich course in electrical engineering. Courses in applied chemistry, chemical technology and industrial chemistry number eight and for these there have been 76 first-year students, 46 second-year and nine third-year students. For the two courses in chemical engineering there have been nine first-year and two second-year students.

New Methods of Polymerising

(Continued from page 520)

that of other plastics materials, but nevertheless giving a unique combination of properties, including good mouldability.

Polycarbonates with properties not widely different from epoxides and excellent for potting compositions might soon be available at prices below that of nylon. There were propylene polymers and ethylene polymers, why not polymers of ethylene oxide?

Mr. Collinson stressed the importance of improved temperature resistance, particularly in this age of rocket and space travel. In that connection thermosetting materials, such as phenolics and epoxides had a good start.

Discussing the radiochemical field, Mr. Collinson spoke of recent work that had shown that compressed ethylene exposed to irradiation by gamma-rays polymerised without the use of high temperatures.

Taking into account the increasing speed of transition from laboratory to commercial production and assuming a growth rate in the next 25 years proportional to that for 'current materials', the production of new materials (those developed since 1957) could be assessed as 646,000 tons in 1983.

Referring to 'current materials' (those in commercial use in 1957, but developed since 1933), Mr. Collinson said that by far the largest increase in demand would come from new applications. Here he instanced increased interest in the US in plastics for the building industry, stating that if 5 per cent of the annual amount of building materials used in the UK were switched to plastics, then the production demand on the plastics industry would increase by 50 per cent.

Taking into account expansion plans for polythene, which would increase output by 37,000 tons a year, it was assumed that other 'current materials' would expand at an accelerating rate for at least two more years before settling to a sustained pace. Mr. Collinson estimated that production in 1983 would be 1,094,000 tons.

Increased demand for 'old materials' (those in commercial use in 1933) would come from a higher per head consumption of plastics materials. It was not likely that the next 25 years would see any startling new compounds within the field or any large increase in new uses.

Some of the expansion might be offset by the replacement with newer materials. Mr. Collinson forecast a sustained rate of growth at simple interest for the 'old materials', reaching a production figure of 360,000 tons in 1983.

Obituary

MR. E. G. PICKERING, joint managing director of Johnson Matthey and Co., died on 16 September at the age of 59 after a prolonged illness. Mr. Pickering, who joined the company in February 1916, became joint managing director in July 1952.

Analytical Review

THEORY OF END-POINT DETECTION REVIEWED

IN a review article (*Talanta*, 1958, Vol. I, No. 1), Flaschka, one of the leading exponents of the complexometric method of analysis, gives the theory of end-point detection in such titrations and deals with the thorny problem of selectivity. For successful titration, a stability constant $> 10^8$ is necessary for the metal chelate and a metal ion-indicator complex constant of at least 10^4 . For selective titration of one metal in the presence of another with a visual indicator, Log. K for the ion being determined must be greater than that for the other cation by 8-10 units. When a visual indicator is not used, a separation of 6 units is sufficient.

Takahashi and Niki in this same journal, trace developments in recording polarography. The development of instruments has depended on progress in the construction of recorders. Pen recording instruments of the photo-pen type, the ammeter type (d.c. amplification) and the potentiometer type (with automatic balance) are reviewed. Close attention is focused on the compensating-bridge instrument which is widely used in Japan.

Alkaline Hydrolysis of Thioacetamide

Peters and Swift report on studies of the alkaline hydrolysis of thioacetamide. In an ammonia buffer (pH ≈ 10) the rate of sulphide formation is first order with respect to reagent concentration and second order with respect to ammonia. In carbonate-hydrogen ion buffer systems the formation was first order with respect to both thioacetamide and carbonate ion concentration. In both media, hydrolysis proceeds at a greater speed than in sodium hydroxide solution.

A contribution from the Argonne National Laboratory reports on the paper chromatography of selenium, tellurium, potassium and bismuth using an HCl/HF medium. A clear separation with 100 per cent yield of ^{210}Po from bismuth was obtained by this method. Sodium hydrogen glycolate is recommended as a reference buffer by Keyworth and Hahn. In 0.2 M solution this substance has a pH of 3.40 ± 0.02 which is constant over a wide range of temperature. This buffer is an interesting one in that it has a long shelf life, does not precipitate common metal ions (except Hg_2^{2+}) and has a high buffer index. (The pH is unaffected by twofold dilution or by addition of salt up to 0.05 M.)

McKinney and Reynolds report on the photometric titration of many phenols in butylamine with an alcoholic solution of sodium hydroxide. Phenols with pK (H_2O) values of 5-11 were titrated without undue difficulty. The end-point was detected by recording the absorption of monochromatic light appropriate to the phenate ion concerned, during the titration.

Jancik and Körbl describe the extractive separation of copper from a number of other cations by means of chloroform and the Cu(I) pyridinolalide complex system. Zinc was masked against extraction by iminodiacetic acid, but not cadmium and

By

T. S. West, Ph.D.

At the beginning of last month the first volume of 'Talanta,' an international journal of analytical chemistry, was issued. In this month's article, Dr. T. S. West reviews the contents of this new publication. Chief editor of the new journal is Dr. C. L. Wilson, reader in analytical and inorganic chemistry, Queen's University, Belfast.

mercury. The copper in the chloroform extract was equilibrated with ammonia solution and titrated complexometrically in the aqueous phase.

Diehl and Buchanan find that the iron II-tris (4:7-diphenyl-1:10-phenanthroline) complex reacts with cyanide ion in neutral solution to form a violet coloured complex. Since copper in either valency state does not interfere, it is possible to apply the method to the determination of traces of iron in copper metal. Feigl and his co-workers report on the application of the technique of pyrohydrolytic cleavage to organic spot testing. This interesting technique involves heating the organic compound with a water donor such as oxalic acid dihydrate or hydrated manganese sulphate. The water released from these hydrates (a range of temperatures is available depending on the hydrate chosen) is specially active and accomplishes hydrolyses which cannot be achieved by water itself.

Gaynor and Skinner describe an empirical cloud-point method for the determination of polymer concentrations in very dilute solution (1 p.p.m. or less). Munemori has used electrically generated dithionite ion for the coulometric titration of various dyestuffs with photometric determination of the end-point. The spectrophotometric titration of the alkaline earths and magnesium with EDTA and Solochrome Black T, following chromatographic separation on paper strips, is described by Headridge and Magee. Triethylene tetramine is used by

Reilley and Sheldon for the selective potentiometric titration of several metal ions either alone or in conjunction with EDTA. A mercury indicator electrode is used to detect the end-point.

Körbl, Vydra and Pribil report on the differences in indicator properties of different preparations of Calcein. It would appear that the response of this indicator depends quite critically on its purity. Ahmed and Lawson have used the 4-amino-4'-chlorodiphenyl reagent for the determination of milligram amounts of sulphate: a spectrophotometric measurement (u/v) is made of the excess reagent. The method was applied to the analysis of coals and humic acids.

Schulek and Burger have written an introductory paper on the use of interhalogens as reagents for the substitutive halogenation of aromatic compounds in aqueous solution. Banick and G. F. Smith report on the u/v spectrophotometric properties of the iron III chelates of various α, α dipiridyls in glacial acetic acid. The compound formed with 4,4' diphenyl-2,2'-dipiridyl has the largest molar absorptivity. Erdey and Rády favour the use of ascorbic acid as reagent for the potentiometric titration of gold (III). Mercury (II), Cu (II) and Fe (III) do not interfere, but Pt (IV) causes a positive error. G. G. Rao and V. N. Rao write on the analytical application of cacotheline with particular reference to the colorimetric determination of iron (II) and (III).

Two short communications are concerned with the titrimetric determination of mercuric chloride by means of potassium cyanide, with the pH indicator thymol blue to detect the end-point (Moss, Pollock and Magee) and with the rapid micro-analysis of phosphorus in organic compounds by an oxygen flask method (Belcher and Macdonald).

New Session Syllabus of Sir John Cass College

THE SYLLABUS of lectures for the 1958-59 session at the Sir John Cass College, Aldgate, London EC3, includes several evening courses of interest to chemists. These are: 'Spectrochemical analysis' by Mr. A. S. Nickelson, on Wednesdays, starting 1 October. 'Absorption spectroscopy' by Mr. A. R. Philpotts, on Fridays, starting 3 October. 'Radiochemistry and radioactivity' by Dr. A. G. Maddock, on Tuesday, starting 14 October—fee £1.

Twenty lectures on 'Statistical Methods in scientific and industrial research' for chemists and biologists by Dr. A. J. Fuell, on Mondays will start 22 September. Part one of a course on 'Electronic computing systems' on Wednesdays will begin on 8 October.

Reactor Pressure Vessel

A contract for the supply and construction of the reactor pressure vessel for the advanced type of gas-cooled graphite-moderated reactor to be built by the UK Atomic Energy Authority is to be awarded to Whessoe. The vessel will operate at considerably higher temperatures than those to be used at nuclear power stations now being built.

Post-Graduate Apprenticeships in Chemical Engineering

SINCE deferment arrangements were extended in 1957 to bring chemical engineering graduates into line with other engineering graduates who have a call-up deferment to allow them to undergo two-year postgraduate apprenticeships in industry, there has been a rapid increase in the number of schemes for chemical engineering graduates.

The following firms now run post-graduate training schemes approved by the Institution of Chemical Engineers: Albright and Wilson (Manufacturing) Ltd., Oldbury; Babcock and Wilcox Ltd., London NW1; British Coking Industry Association, London W1; British Enka Ltd., Liverpool 9; Constructors John Brown Ltd., London SW6; Courtaulds Ltd., London EC1; Distillers Co. Ltd., London SW1; Dunlop Research Centre, Birmingham 24; Esso Petroleum Co. Ltd., Fawley; W. J. Fraser and Co. Ltd., Romford; Gemec Ltd., London W1; Humphreys and Glasgow Ltd., London SW1; ICI Billingham Division; Kellogg International Corporation, London W1; Kimberly-Clark Ltd., Maidstone; Lewis Berger and Sons Ltd., London W1; Marchon Products Ltd., Whitehaven; Mobil Oil

Co. Ltd., London SW1; Norris Brothers Ltd., Burgess Hill; Power-Gas Corporation Ltd., Stockton-on-Tees; Scottish Agricultural Industries Ltd., Leith; Shell Refining Co. Ltd., London EC2; Simon-Carves Ltd., Stockport; Peter Spence and Sons Ltd., Widnes; John Thompson, Wolverhampton; Unilever Ltd., London EC4; Union Carbide Ltd., Chemicals Division, London W1.

After consultation with the Association of British Chemical Engineers and the British Chemical Plant Manufacturers' Association, the education committee of the Institution of Chemical Engineers, has issued notes on graduate training. It is stated that the object of the scheme is to continue training on a fairly broad practical basis. Practical training should be given in process plant fabrication, development, design and operation. It is particularly stressed that attention should be given to the importance of cost; economic appraisal, capital and product-cost estimation should receive special attention.

It is stated that one of the most useful ways in which a young man, whatever his ultimate career, can gain experience is to be a member of a commissioning team.

Armour's Tertiary Amine, C25, Now Produced in UK

WITH the publication of bulletin L.25, entitled 'Ethomeen C/25' Armour Chemical Industries Ltd. announce the availability of the first of their ethoxylated amines from British production.

Ethomeen C/25 is a tertiary amine produced by condensing a primary coco amine with 15 molecules of ethylene oxide and behaves as a non-ionic. It is, however, used sometimes as a cationic chemical, e.g. it forms quaternaries and other salts; or as a non-ionic, e.g. it is an excellent emulsifier. It is an amber liquid with a specific gravity of 1.042 at 25°C and an average molecular weight of 875. An 0.1 per cent solution of Ethomeen C/25 in distilled water at 25°C has a surface tension of 41 dynes/centimetre.

Depending on the type of amine used and the number of ethylene oxide molecules added to the amine, a large range of Ethomeens can be made, each with its specific characteristics, and applications. The shorter the amine chain and the greater the number of ethylene oxide molecules, the more water soluble is the Ethomeen.

Ethomeen C/25 is already in use in a number of industries in this country. It is used in the textile industry, as an anti-static agent for synthetic fibres, in the production of metal cleaning solutions, in paint strippers, as an emulsifier for agricultural toxicants, in polishes and numerous other systems. It is also used as a

secondary flotation agent and as a chemical intermediate. Other applications include its use for demulsification of oil/water emulsion, a stabiliser for certain latices and emulsions, and as an additive to inhibit corrosion.

Technical bulletin L.25 and samples of Ethomeen C/25 are available on request from Armour Chemical Industries Ltd., 4 Chiswell Street, Finsbury Square, London EC1. The product is available in 45 gall. steel drums each holding about 420 lb. (190 kg.) and in road tankers.

Periodate Oxycellulose Derivatives on Show

MEMBERS' days are to be held at the British Cotton Industry Research Association on 9 and 10 October. Annual meeting will be held on 9 October.

Exhibits will include the chlorite bleaching of cotton and scouring and bleaching of blends of cotton and man-made fibres. Another demonstration will concern the derivatives of periodate oxycellulose. Unexpected features of the structure of crystalline compounds obtained by periodate oxidation will be illustrated with a variety of molecular models. The use of infra-red spectroscopy in the elucidation of the structure will be stressed and the reactions of amines and alcohols with periodate oxycelluloses illustrated.

National Adhesives Open Slough Plant for PVA Emulsions

A NEW plant for the polymerisation of a wide range of polyvinyl acetate emulsions is now on stream at Slough, Bucks. It is owned by National Starch Products Inc., New York City, and operated by National Adhesives Ltd., a subsidiary.

According to Mr. A. R. G. Williams, managing director of National Adhesives, the new plant will provide a centre for research and technical service facilities for emulsion technology in the UK. At the same time it will encourage the free exchange of ideas and developments in these fields between National's UK technologists and the company's research and development personnel in the US.

The new installation is producing a complete range of polyvinyl acetate emulsions for the paint, textile, paper and cement industries for shipment in bulk quantities to all areas of the UK, South Africa, Australia, New Zealand and the Continent.

ICI Chairman to Meet Open Pan Salt Deputation

SIR ALEXANDER FLECK, chairman of Imperial Chemical Industries Ltd., has agreed to meet a deputation from the Winsford (Cheshire) Council to hear their views and representations on the town's industrial situation. Concern was expressed at a recent meeting of the council at the situation that had arisen in Winsford through the contraction of the local salt industry during ICI's ownership. ICI Salt Division had announced that open pan salt production would cease at Winsford next July.

Sir Alexander, in a letter to the council, stated that a preponderance of the Winsford salt industry was based on open pan production, a process doomed to obsolescence because of its uneconomic use of fuel and manpower. It had been his company's aim to make such technical and other changes in the Winsford production as to make it more efficient and hence of greater permanence as a local industry.

'That we have had some measure of success is indicated by the fact that, notwithstanding the inevitable decline in open pan production, the production of salt, including rock salt, at Winsford is approaching the figure of a quarter of a million tons, a figure comparing favourably with the immediate pre-war tonnage.'

Jessop's Titanium Alloys

William Jessop and Sons Ltd. have developed a series of new titanium alloys (British patent 796,781). The alloys are stated to have exceptional resistance to creep at temperatures of about 400°C. They contain between 2 per cent and 10 per cent of molybdenum and from 0.1 to 2 per cent of silicon.

The patent indicates that the alloys may contain tin or zirconium, boron or beryllium and some other strengthening or precipitation hardening compounds.

INDIA'S PAINT PRODUCTION DOUBLED IN SEVEN YEARS

Plans to Produce Plasticisers & Solvents

NOTABLE advances have been made in recent years in India in the manufacture of high quality paints, enamels and varnishes. Production rose from 27,950 tons, valued at Rs.5.5 crores (£4.12 million) in 1950, to 42,000 tons, valued at Rs.13 crores (£9.7 million) in 1957. The target fixed for 1960 is 60,000 tons per annum.

In the raw materials field, alkyd resins, anatase titanium dioxide and aluminium paste pigment are now being produced, although India's paint industry still imports annually raw materials worth Rs.1.5 crores (£1.1 million). Schemes for the manufacture of several pigments, synthetic resins, plasticisers and basic chemicals for the industry are being implemented. These include the following: *pigments*—rutile, titanium dioxide, phthalocyanine blue, prussian blue from iron oxide sludge; *synthetic resins*—phenolic resins, pure and modified, and maleic resins; *plasticisers*—dibutylphthalate; *solvents*—butyl and amyl alcohols, butyl and amyl acetates, glycol ethers and esters, methyl ethyl ketone, methyl isobutyl ketone, diacetone alcohol; *basic chemicals*—phthalic anhydride, pentaerythritol, urea, phenol, and formaldehyde. These developments will greatly facilitate production of synthetic and nitrocellulose finishes.

Sulphur Needs

Sulphur requirements and resources. Elemental sulphur, for the manufacture of sulphuric acid is not available in India. Italy and Japan were the pre-war sources of supply, but these have been cut off since the start of the second World War. Emergency arrangements then made with the US have continued. During the 11 months ended November 1957, India imported 15,822 tons of refined sulphur alone, valued at Rs.73.3 lakhs (£550,500) besides several thousand tons of crude rock sulphur. Alternate sources for supply of sulphur are now being examined.

The manufacture of sulphuric acid from sulphur-containing raw materials available in India has been under consideration. The exploiting of gypsum deposits in Rajasthan is now regarded as economic.

There are, however, possibilities of producing sulphur from the Sambhar bitterns, the Amjor pyrites, and gypsum and the magnesium chloride obtainable from sea water. A committee appointed by the Ministry of Heavy Industries estimates that the first source might provide 6,000 tons of sulphur per year, but the discovery of large deposits of iron pyrites, of the order of several million tons, at Amjor in Bihar is considered more promising. Deposits of pyrites are also reported in the Himachal Pradesh

and Mysore. Investigations carried out at the Regional Research Laboratory in Hyderabad showed that if steam is passed over the ore heated to 800°C for 170 minutes, the entire pyritic sulphur is recovered as elemental sulphur (35 per cent) and hydrogen sulphide (65 per cent). A further quantity of elemental sulphur is obtained by reacting the hydrogen sulphide produced, with sul-

Indian Newsletter

- Synthetic resins and pigments now home produced
- Extraction of sulphur from gypsum, bitterns and pyrites being explored
- Sodium sulphide from barytes process perfected
- Delhi research institute's new technique for urea and formaldehyde resins.
- Tamarind as a rich source of tartaric acid

phur dioxide obtained by passing air at a slow rate over pyrites heated to 400°C.

Some pilot scale trials at Mithapur of a process for extracting sulphur from the gypsum and magnesium chloride obtained from distillery waste and bitterns are promising, and it is estimated that about 5,000 tons of sulphur per year could be produced at Mithapur and, later, also at Porbunder.

The recovery of sulphur from coal carbonisation gas effluents containing hydrogen sulphide, sulphur dioxide, etc., is also being considered.

Sodium sulphide from barytes. A method of manufacturing sodium sulphide from low-grade Indian barytes has been worked out at the University College of Technology, Calcutta. The price of sodium sulphide has gone up considerably since the depletion of natural sodium sulphate deposits in Rajasthan, and the evolution of the new process is of great significance to operators of tanneries, paper mills and textile industries in the country.

Powdered barytes (80 per cent barium sulphate), powdered coal and alkali (sodium carbonate or caustic soda) are intimately mixed with the addition of a little water (wet mixing) or without addition of water (dry mixing) and reduced in an electrically-heated muffle furnace. The yields of sodium sulphide were greater when the wet mix was used.

Santonin from Indian Artemisia. The main indigenous source of santonin at *Artemisia maritima* which grows in certain areas of Kashmir and has a santonin content of 2-2.5 per cent. Recently another species of the plant, *A. brevifolia*, which grows abundantly in the Lahaul valley (Kangara dt.) and in many parts of Kashmir, has been discovered. It has an average santonin content of 1.3 per cent.

Extraction methods have been investigated at the Sir P. C. Ray Research Laboratory of the Bengal Chemical and Pharmaceutical Works Ltd., Calcutta, and a simple and economic commercial method has been developed using materials and equipment available in this country. The process depends on the solubility of santonin in benzene (4.02 g. per 100 g. of solvent) and the formation of its water-soluble calcium salt with lime, from which it is recovered as a precipitate by addition of hydrochloric acid.

Extraction Apparatus

The apparatus used is an ordinary extraction plant of copper working on the Soxhlet principle and having an efficient condensing arrangement. The material mixed with about 25 per cent straw cuttings and 25 per cent water is charged in the extraction vessel and extracted with benzene (b.p. 80°-100°C). After 24 hours the solvent is distilled off and the residue boiled with lime water. Santonin passes into solution as calcium santoninate. The mixture is filtered, the filtrate cooled and treated with commercial hydrochloric acid until it is just acidic to Congo Red, and then allowed to settle for 24 hours in the dark. The precipitated santonin is filtered through cloth and the filtrate discarded.

Any resinous contamination is removed by repeated treatment with sodium bicarbonate solution (4 per cent). The unaffected santonin is filtered off, and after three washings, crude santonin of pale yellow colour is obtained. This is washed with water and dried at ordinary temperature in the dark. The crude dried santonin is now crystallised from alcohol (80 per cent; 12 parts) or methylated spirit with decolorising charcoal (2 per cent). For further purification the product is recrystallised from 16 parts of 40 per cent alcohol with 1 per cent activated carbon. The purification is carried out in the dark, otherwise the yellow photosantoninic acid ($C_{15}H_{20}O_6$) is produced.

Potassium chloride from sea bitterns. A new process has been developed at the Central Salt Research Institute, Bhavnagar, for the recovery of potassium chloride from sea bitterns which are now wasted. India's annual production of sea salt is of the order of 3 million tons. The waste bitterns contain appreciable quantities of potassium chloride and it is estimated that 80-85 thousand tons of potassium chloride could be recovered from them and used as fertiliser.

The method developed is simple in operation, uses inexpensive equipment and produces potassium chloride of 90

per cent purity. The biterns are concentrated to 36-38° Be by solar evaporation and treated with lime slurry precipitate to the magnesium sulphate. The supernatant liquor (4-5° Be) containing mostly potassium chloride and chlorides of sodium and calcium is concentrated to 34° Be when most of the sodium chloride and potassium chloride crystallises out.

Refining of cashew shell liquid. Three grades of cashew-nut shell liquid are produced in the cashew factories in India, but of these only the first grade oil is of exportable standard. Now the Industrial Research Laboratory, Kerala, have developed a method of upgrading the quality of the second grade. The refined oil produced by the process has an iodine value of 235-245, is free from carbon and satisfies the oven test.

Impurities contained in the second grade oil include potassium, sodium and iron salts which exist in chemical combination with the phenolic constituents, and since they are soluble in the usual solvents, they cannot be eliminated by simple filtration, centrifuging or even by clarification. The oil is treated with concentrated sulphuric acid, the quantity of acid required being determined from the acid equivalent of the oil. The acid is mixed with an equal quantity of methylated spirit and the mixture after cooling is added to the bulk of the oil, in small quantities at a time, with vigorous stirring. The reaction may be carried out in an earthenware or porcelain vessel cooled by running water. After all the acid mixture is added, the oil is slowly heated to 350°F and kept at that temperature for about half an hour, then allowed to cool to about 200°F and filtered through a basket type centrifuge using filter cloth.

Textile Finishes

Stable urea formaldehyde for textile finishes. Urea formaldehyde resins have been successfully used for treating textile fabrics to improve their shrink and crease resistance. The 'know-how' for the production of these resins in India has been developed at the Shri Ram Institute for Industrial Research, Delhi, and it is now possible to manufacture stabilised low molecular weight reaction products of urea and formaldehyde. Urea and formaldehyde are reacted in the presence of modifiers after suitably adjusting the pH, and on completion of the reaction the batch is filtered, adjusted to the 50 per cent solids, and packed for storage.

Tartaric acid from tamarind. *Tamarindus indica* (tamarind) is one of the richest sources of tartaric acid; the pulp of the ripe fruit contains 12 per cent of the acid while the unripe fruit has an acid content of about 15 per cent. A process developed at Holkar College, Indore, for the extraction of tartaric acid from tamarind using ion exchange resins gives a high purity product (75 per cent) in 80 per cent yield.

The fruit is freed from the shell and boiled in distilled water for 3 hours, macerated and filtered first through a cloth and then through a Buchner funnel. The hot filtered solution is passed

through a column containing cation-exchange resin, Amberlite IR-4, in hydrogen cycle so as to convert all salts into acids. The solution obtained is again passed through a column of anion-exchange resin, Amberlite IR-4B, in sulphate cycle. The column is then washed with distilled ion-free water till free from nitrogen and iron compounds. The elution is then done using 2N sulphuric acid—the same acid being used for both the regeneration of cation-exchange resin in hydrogen cycle and anion exchange resin in sulphate cycle. Pretreatment with cation-exchange resin is essential because otherwise on cooling potassium tartrate starts precipitating from the solution and blocks the column.

The eluate, which is brownish in colour, darkens on concentration of the solution. However, the tartaric acid

crystals obtained from the solution by slow evaporation are only faintly coloured, and are free from sulphate or chloride ions.

Dichromates industry. As stated in CHEMICAL AGE last week (p. 491) the Indian Tariff Commission has recommended that protection granted to the dichromates industry should be discontinued from 1 January 1959, and this has been accepted by the Government of India. Taking the past trends into consideration, the future demand for dichromates is expected to increase steadily to 5,000 tons a year by 1960.

There are at present five units in production in the country with an aggregate capacity for production of sodium dichromate (inclusive of capacity for the production of potassium dichromate) 4,546 tons per year.

SCI Meeting Hears of Canada's Rapidly Growing Chemical Industry

THE prediction that consumption of chemicals and allied products in Canada, which represented 5.1 per cent of the gross national product in 1955, would be in the neighbourhood of 10 per cent by 1980 was made last week by Mr. H. Greville Smith, president of Canadian Industries Ltd. Mr. Smith stated this in his presidential address to

vinced more and more businessmen that there was a need for certain Government participation to promote the prosperity and welfare of the country. If their national development had been left entirely to private enterprise, Canada would not have attained its present stature as a nation.

Sir Robert Robinson, OM, a director and chemical consultant of the Shell Chemical Co. Ltd., succeeds Mr. Smith as SCI president. Sir Robert, who won the Nobel Prize for chemistry in 1947 was Waynflete professor of chemistry at Oxford from 1930 to 1935.



SIR ROBERT ROBINSON,
new SCI President

more than 400 leaders of the chemical industries of Canada, the US and the UK at the annual meeting of the Society of Chemical Industry in Montreal.

Canada's growing chemical industry could, he declared, look forward to a brilliant future based on the abundant natural resources of the country, which continued to offer the industry endless opportunities.

Mr. C. D. Howe, former federal Minister of Trade and Commerce, in his Messel Medal lecture on 'Industry and Government in Canada' said that Canada's development could not be left entirely to private enterprise because there was scope as well as need for Government-organised industry. The Crown Corporation was an asset to the country and Mr. Howe defended such corporations as TCA, the Polymer Corporation and others. He added that Canada's wartime experience had con-

Murphy to Distribute Fisons Pest Control Lines

SO THAT they can further concentrate their technical and commercial efforts in providing an improved service to UK farmers, Fisons Pest Control Ltd., 95 Wigmore Street, London W1, have reached an agreement with the Murphy Chemical Co. Ltd., Wheathampstead, Herts. Under this agreement Murphy's will be responsible for the distribution of all those crop protection chemicals suitable for use on horticultural crops and on hops, throughout the UK.

Fisons Pest Control chemicals which Murphy's will distribute are: Diazitol (containing Diazinon for control of aphid and other fruit pests); Phenatol (containing Phenkapton for red spider control); Pestox 3 (systemic insecticide based on Schradan for use on hops); Pestox Plus (systemic and contact insecticide for use of hops); Blitox (wetttable copper oxochloride fungicide for use on hops); and Blidust (copper coated dust for use on hops).

Inquiries relating to these products for horticultural purposes should in future be addressed to the Murphy Chemical Co.

Earlier this year, Fisons Pest Control announced a link with the Geigy Co. Ltd., under which they now market all agricultural chemicals, except DDT, produced by Geigy.

Overseas News

EXPANSION PLANS OF EAST GERMANY'S THREE LEADING CHEMICAL UNITS

IN AN INTERIM report, the East German Government has issued operating details of three of the Communist zone's most important chemical concerns: Leunawerke 'Walter Ulbricht'; Bunawerk Schkopau; and Stickstoffwerk Piesteritz (nitrogen producers).

The Leunawerke employs at present some 30,000 workers, states the report, and produces about 90 per cent of Eastern Germany's output of ammonia and a third of its fuel. At present, with an annual production of 340,000 tons of nitrogen, the plant is expanding its nitrogen-producing installation to a capacity of 400,000 tons. Also forecast are increases in the production of fuel, industrial alcohol, urea, formamide, caprolactam and industrial gums. Other products of the plant include glycerine substitutes, plastic emulsions, synthetic oils and textile additives.

A total of 300 million marks (approximately £25 million) is tied up in investments for the plant until and including 1960, after which date further expansion will take place, particular interest being paid to the use of coal with a high salt content as a fuel for the plant.

The Bunawerk Schkopau, with a staff of 18,000, plans to lift production by 20 per cent by the end of 1960. The production of synthetic rubber has already been raised considerably (no set amount is quoted during this year. The vinyl chloride plant erected in 1955 is being extended, and by the end of 1959 should be producing 9,700 tons a year, and by the end of 1960 four furnaces, two of which are newly erected, will be engaged in the production of carbides by remote control at Dunkelsteuerung. The capacity of the plant to produce p.v.c., is also to be extended and the installation producing calcium nitrates would be brought into full production. Polystyrene is to be produced at the rate of 11,000 tons a year by 1961.

At Piesteritz, where pure nitrogen production stood at 20,000 tons in 1957, the 1960 production figure will be 40,000 tons, the report states. A plant turning out calcium carbide will be completely rebuilt since it has become too small for present-day requirements. The organic glass plant is also to be extended. Piesteritz employ a staff of 6,000.

Sales Cartel For Thomas Phosphate in Germany

Application has been made by Thomas-phosphatfabriken GmbH, Düsseldorf, to the Federal Cartel Bureau for a sales cartel for Thomasphosphat.

The cartel would comprise those who are members of Thomasphosphat GmbH and Wintershall AG, Kassel, said to produce Thomasphosphate. Thomasphosphat GmbH would act as business office for the cartel. The purpose of the cartel would be

to market all ground or unground basic slag for fertiliser purposes, or products made from it produced in the domestic product area. (Thomas phosphate or Thomas slag, is the ground or unground slag produced containing a minimum of 8 per cent of citric acid soluble phosphoric acid) Members of the cartel would bind themselves to Thomasphosphat GmbH to supply their products to the business office on conditions, to be reviewed from time to time. There would be a 'Thomasphosphat trade mark' and Thomas potash would be sold as 'Thomaskali'.

If agreement is reached the cartel would apply for three years and would run to 30 April 1960. If agreement cannot be reached, then the matter will go to court of arbitration, although each individual member has the right to a hearing in ordinary court.

Australian Plans to Produce Petrol from Brown Coal

Annual production of synthetic petrol to be produced from brown coal mined at Morwell, 90 miles from Melbourne, Australia, is expected to be 80 million gall. by 1963. The Melbourne Gas and Fuel Corporation anticipate that the plant should produce enough petrol for Victoria's primary producers. Synthetic petrol will cost more to produce than ordinary petrol, but actual figures will depend on how cheaply the corporation can produce gas. It is estimated that about 40 lb. of brown coal would be needed to produce just over 1 gall. of petrol.

Cyanamid Acrylonitrile

This month the new extension to the acrylonitrile facilities of American Cyanamid will be completed. It will double existing capacity to a total of 100 million lb. a year. Total US capacity for acrylonitrile is this year expected to be between 170-176 million lb. a year.

Chinese Technicians Design Large NH₄Cl Plant

Construction has begun in Tientsin of a chemical fertiliser plant designed entirely by Chinese technicians. By 1962 it is scheduled to turn out 320,000 tons a year of ammonium chloride and soda ash. In Tsinan, Shantung province, work has begun on the setting up of a chemical fertiliser plant with an estimated capacity by 1962 of 100,000 tons of synthetic ammonia a year.

US-Dutch Combine Starts Platinum Catalyst Production

A new plant for making platinum reforming catalyst for the oil industry has started production in Amsterdam. Built and managed by Ketjen, it is the first

enterprise of Cyanamid-Ketjen NV, a new 50/50 subsidiary of American Cyanamid Co., New York, and Ketjen.

Manufacture is under licence from Standard Oil of Indiana, and the first output is reserved for the new Powerformers of Esso's affiliates and licensees in France, Germany, Italy, the UK, Ireland, South Africa, Japan and Irak. The new ultraforming catalyst is to be marketed under the trade designations 'C-K 103' and 'C-K 106' for the 0.3 per cent and 0.6 per cent platinum types respectively. These are similar to the aeroform PHF1 types produced by the American Cyanamid Co. in the US.

Union Carbide Build Chemical Plant in India

National Carbon Co., Bombay, a subsidiary of Union Carbide of the US, are constructing an \$8 million petrochemical plant which is expected to be commissioned in 1960. Product range will be: polythene resins (6 million lb. a year); solvents, including butyl alcohol, butyl acetate, ethyl acetate, other acetic esters, acetic acid, ethylene dichloride; and other chemicals.

African Sulphur Dioxide Plant on Stream Early Next Year

Early next year African Explosives and Chemical Industries will start the production of refrigeration grade sulphur dioxide at their Umbogintwini factory near Durban. One of the main outlets for this product will be to a petrol refinery in Durban. At present sulphur dioxide is imported from Holland, the UK, the US and West Germany, but the facilities at Umbogintwini will make Southern Africa completely independent of outside sources. The Natal plant is designed to produce double the present demand of the material.

New East German Process for Hydrogenation

The East Berlin chemical company of VEB Berlin-Chemie has announced that it has brought into use a new apparatus which eliminates the disadvantages encountered with conventional methods of hydrogenation—poor reaction of elements, the limiting of volume capacity and the difficulty of heat regulation.

Instead of glass containers and agitators being employed, as is usual, says a spokesman of the undertaking, Berlin-Chemie uses Jena hanging containers with inbuilt cooling and heating pipes. The reaction compound is driven by means of a porcelain pump through a gas distributor. Using this method, a close combination of the reaction compound and hydrogen is obtained.

Sulphuric Acid Production in South Africa

South Africa is now a major world producer of sulphuric acid with a yearly production exceeding 900,000 tons a year. In 1938, production of sulphuric acid in South Africa was 77,000 tons a year. Most of today's production is used in the uranium recovery plants. Previously South Africa imported sulphur and neglected a valuable source of raw material

found as a by-product of gold mining iron pyrites. Foremost in sulphuric acid production is Virginia, Orange Free State. By-product iron pyrites recovered at the Virginia and Harmony Mines, is used for acid production. The Virginia mine now produces more than 370 tons of acid a day. The Harmony mine is now building a sulphuric acid plant which is due by July 1959.

Maleic Anhydride Plant Proposed for Spain

Resinas Poliesteres SA, Unquinesa and UEE with the French company, Saint-Gobain, have received permission for a proposed maleic anhydride plant. The plant will have a capacity of 1,500 kg. a day and will be sited at Penacastillo near Santander.

Knapsack's Award for New Atomised Ferrosilicon

Mining specialists in the US have made an award to Knapsack-Griesheim, AG, Cologne, for their new atomised ferrosilicon. Ferrosilicon powder, containing 15 per cent silicon, for the constitution of heavy media is used in many separation plants. In the new process developed by Knapsack-Griesheim the molten ferrosilicon is atomised by air and steam and the heavy media produced by this method is claimed to show several outstanding properties.

In contrast to the conventional angular media, it is reported, the round form and smooth characteristics of the individual particles offer, among other things, resistance to corrosion. The claim is made that no interaction is produced between the iron and the silicon during processing; losses due to adhesion are reduced; and the pulp density which can be attained at workable viscosities is considerably higher than those obtained with ground ferrosilicon, enabling heavy media separation.

French Houdry Synthetic Rubber Plant Proposals

The US president of the Philadelphia Houdry Process Co. is to visit France for talks with the heads of France's leading synthetic rubber producing concern, Socabu, on the setting up of a Houdry subsidiary in France. Talk is at present of the establishment of a synthetic rubber plant with an annual capacity of from 30,000 to 40,000 tons and costing from \$15 to 20 million.

The Houdry process is now being used at the newly-opened West German plant of Bunawerke Hüls, at Marl. (See CHEMICAL AGE, last week, p. 481.)

Germanium as Catalyst

Specially prepared pure germanium works well in the laboratory as a catalyst for some chemical reactions. This was reported by Dr. Y. L. Sandler, Westinghouse Research Laboratories, Pittsburgh, Pennsylvania, US, at the 134th national meeting of the American Chemical Society. Catalytic activity of the metal, after it is subjected to an electrical discharge, was stated to be as high as

that found with the best catalytic materials.

Dr. Sandler said that certain chemical changes involving hydrogen were greatly accelerated at -310°F . The prepared germanium is stated to act as a catalyst through an electronic interaction that creates weak chemical bonds at the surface of the metal. This effect is thought to be caused by a number of active electrons concentrated on the surface. In this catalytic action, called 'weak chemisorption', germanium collects surrounding atoms of molecules and later reverses the process.

Basrah Fertiliser Project

The Republic of Iraq is to build at Basrah a plant for the production of 250,000 tons a year of ammonium sulphate and 21,000 tons of sulphuric acid. Tenders have been invited for the engineering, supply, erection and commissioning of the complete plant.

Mercaptans Deodorised To Give Useful By-products

The odour of mercaptans can be conquered, it is claimed, by a new alkylating reaction without any loss of activity. M. B. Denworth, Consolidated Coal Co., addressing the Division of Organic Chemistry, 134 ACS National Meeting, reported that the process could be valuable in utilising the low cost by-products—thiols in spent caustic recovered from desulphurising gasoline. Direct pressure alkylation of the thiols with iso-butylene, using a boron trifluoride catalyst has proved successful.

Direct *tert*-butylation of thiophenol produces 70 per cent 4-*tert*-butyl thiophenol. With the same reaction, *o*-cresol gives 53 per cent of 4-*tert*-butyl thiocresol.

Tert-butyl thioether is produced almost instantly at room temperature by addition of isobutylene boron trifluoride solution in thiophenol. The thioether, with excess thiophenol transfers the *tert*-butyl group to the thiophenol. Substitution occurs only at the para position.

The *tert*-butyl compounds produced make good intermediates for anti-oxidants, detergents, corrosion inhibitors and additives for lubricating oils. Their odour is also improved.

Polish-Czech Co-operation For Chemical Industries

The Czech Government stated last week that co-operation between the chemical industries of Czechoslovakia and Poland will be further developed. The two countries have set up a joint scheme for the production of dyestuffs, and a system of exchanges of chemical processes. This system includes the supply by Czechoslovakia to Poland of processes in the field of polyesters, viscose fibres, alkali celluloses and aminoplastics, as well as guidance in coke chemicals and the manufacture of tyres from polyesters. Poland is to supply Czechoslovakia with processes in the following chemical fields: calcined potashes, salicylic acid, and light vinyl p.v.c.-based plastics.

Anglo-W. German Plant

Preliminary work on an experimental basis has begun at the Dormagen plant of the German Erdölchemie GmbH, a joint concern of the British-owned BP Benzol und Petroleum AG and the West German chemical manufacturers Farbenfabriken Bayer AG.

Freon Gases Lubricate Metal Alloys at High Temperatures

SEVERAL gases of the Freon family, widely used as refrigerants, have been found to lubricate various metal alloys at temperatures up to $1,200^{\circ}\text{F}$, reported Donald H. Buckley and Robert L. Johnson of the Lewis Flight Propulsion Laboratory, Cleveland, Ohio, US, at the 134th national meeting of the American Chemical Society. The gaseous lubricants are stated to function by combining chemically with the metal to be lubricated and forming a film that reduces friction. Only certain gases will react with particular metals to create such a lubricating compound. Certain nickel and cobalt alloys have been effectively lubricated by the gases known chemically as dichlorodifluoromethane (Freon 12), dibromodifluoromethane and monobromotrifluoromethane. The presence of another gas, sulphur hexafluoride, in small amounts was found to be 'generally beneficial' to the formation of the lubricating film.

Freon-12 was an effective lubricant for soft iron materials as M-1 tool steel at lower temperatures, but the metal was corroded by the gas at temperatures

above 600°F . Freon gases were tried because they were known to be able to withstand temperatures as high as $1,000^{\circ}\text{F}$. When metals slide together, however, frictional heat may produce temperatures at the points of contact as much as $1,100^{\circ}\text{F}$ above the surroundings.

The lubricating gas decomposed at these local hot spots, it was reported, and 'active atoms thus released react with the metal to form compounds capable of effective lubrication.' The lubricants are therefore continuously reformed as needed. Gases containing bromine atoms were found to be more effective with nickel alloys and the chlorine-containing gases were more effective with cobalt alloys.

Optimum combinations gave friction coefficients as low as 0.05 without excessive wear. Quoted as an example of an effective combination was Stellite 98M2 (cobalt, chromium and tungsten) on Hastelloy C (nickel, iron and molybdenum) in monobromotrifluoromethane plus 1 per cent sulphur hexafluoride at temperatures from 600° - $1,200^{\circ}\text{F}$.

PEOPLE in the news

Several board changes are announced by George Kent Ltd., Luton, Bedfordshire. Mr. T. P. W. NORRIS, formerly chief personnel officer of the Vickers group and previously labour manager of ICI Billingham Division, has been appointed director and deputy chairman. Mr. R. E. HANDFORD, B.Sc., deputy managing director, is to relinquish his executive functions after 45 years' service with the company, but retains his seat on the board. Mr. W. A. HARTOP, a director since 1943, has been appointed managing director. COMMANDER P. W. KENT, formerly chairman and managing director, remains as chairman. Two directors retire on 30 September. They are Mr. W. GUY ARDLEY, who joined the firm in 1893 and joined the board in 1914, and Mr. LESLIE H. KENT, who has served on the board for 43 years.

Mr. G. F. LEWIS, A.R.I.C., formerly analytical chemist in the engine laboratory of Associated Ethyl Co. Ltd., at Bletchley, Bucks, will at the end of this month take up an appointment as deputy head of the analytical department of the Laboratory Chemicals Division, British Drug Houses Ltd., Poole, Dorset.

SIR WILLIAM OGG, who is returning to Scotland when he retires on 30 September after 15 years as director of Rothamsted Experimental Station, has accepted an appointment as consultant to Scottish Agricultural Industries Ltd., 39 Palmerston Place, Edinburgh 12. He will now live on his farm near Edzell in Angus. Educated at Robert Gordon's College and Aberdeen University, Sir William was advisory officer in soils at Edinburgh University and the East of Scotland College of Agriculture, from 1924 to 1930. While at the college he prepared a report on land reclamation for the late T. B. Macaulay which led directly to the foundation of the Macaulay Institute for Soil Research at Aberdeen, and

and two years later was transferred to the technical department in head office. Mr. Rutherford joined the technical department of the Terylene council in 1951 and was appointed manager of the Terylene pilot plant at Hillhouse in 1953, a post which he held for three years. Mr. Rutherford went to the Fibres Division headquarters in 1956 as assistant research manager, and in 1957 was appointed production manager, a post which he held until his appointment to the board of the fibres division.

SIR ALEXANDER FLECK, chairman of ICI since 1953 and this year's president of the British Association, is the new chairman of the Minister of Power's Scientific Advisory Committee.

Mr. N. J. FREEMAN, managing director of Imperial Chemicals Insurance, has been appointed a director of the ICI Heavy Organic Chemicals Division, Billingham-on-Tees, Co. Durham.

Mr. PHILIP V. COLEBROOK, production and research director of Pfizer Ltd., Folkestone, was on 23 September appointed managing director. He joined Pfizer in 1952 as works and production manager and became one of the youngest directors of Pfizer anywhere in the world when two years ago, at the age of 32, he was elected to the Pfizer Ltd. board. After leading the rapid building up of the production teams and facilities he was given overall responsibility for quality control and research. He instituted the firm's educational programme providing for university and 'sandwich' training courses.

Mr. MICHAEL SHAW, B.Sc., A.M.I.CHEM.E., A.R.I.C., and Mr. DENNIS ORMSTON, A.M.I.CHEM.E., have joined the board of the newly formed Campbell (Manchester Sales) Ltd., mixer manufacturers, Ajax Works, Campbell Street, Walkden (CA. 20 September, p. 497). Mr. Shaw started his career as chemical engineer with J. Bibby and Sons, Liverpool. He joined ICI General Chemicals Division in 1944 and was concerned with the development of new processes and plants. Since then he has

been continuously associated with design and project engineering, mainly with Petrochemicals Ltd. In 1949 he was awarded the William MacNab Medal of the Institution of Chemical Engineers. Mr. Shaw has also been appointed technical director of the newly formed chemical plant constructing organisation, Project Constructors Ltd. Mr. ORMSTON, who gained the MacNab Medal in 1947, has spent several years with Genatosan Ltd., Loughborough. In 1946 he joined the Chemicals Division of the Distillers Company, where he was engaged on developing new processes and design of production units, becoming chief engineer of the development department. Mr. ORMSTON was also recently appointed chief engineer and a director of Project Constructors. Both Mr. Shaw and Mr. ORMSTON have been connected with development work for atomic energy projects.

Mr. ERIC L. BUSH, chairman of W. J. Bush and Co. Ltd., and managing director of Potter and Moore has recently returned to London from a successful tour of his associated companies in Australia. Prime reason for Mr. Bush's visit to Australia was the opening of new factories for both W. J. Bush, and Potter and Moore at Mentone, Victoria. As well as the Mentone establishment, and offices



Mr. Eric L. Bush

in Melbourne, W. J. Bush have a new modern building and manufacturing unit in Sydney, a new building in Brisbane, branches in Adelaide and Perth, and modern citrus products factories at Mellendong, Western Australia and Northern Victoria. Joint managing directors of W. J. Bush and Co. (Australia) Ltd. are Mr. WILLIAM C. THOMAS, son of the founder of the Australian branch of W. J. Bush, and Mr. J. A. D. PAUL, who joined the London company in 1931, and went to the Australian company after the war.

Mr. L. H. WILLIAMS, a member of ICI's main board, and Dr. J. AVERY, chairman of ICI Dyestuffs Division, are to join the board of Ilford Ltd. (see also p. 532).

The two top executives of W. H. Dorman and Co. Ltd., diesel engineers, Stafford, have left on an extended overseas tour of the firm's markets in Canada, Australia, New Zealand and South and East Africa. They are Mr. DARBY HADDON, chairman and joint managing director, and Mr. J. W. WHIMPENNY, joint managing director and general manager. Sales engineer for the Latin-American and Caribbean areas Mr. E. G. BOYD is at present touring Venezuela, Barbados, Trinidad, Brazil, Uruguay and Argentina, and is due back in mid-November.



Sir William Ogg Mr. C. I. Rutherford

in 1930 he became the institute's first director. In 1943 he succeeded Sir John Russell as director of Rothamsted and consultant director of the Commonwealth Bureau of Soil Science.

Mr. C. I. RUTHERFORD, who has been associated with the development of Terylene since 1951, was last week appointed a director of the Fibres Division of Imperial Chemical Industries Ltd. He joined the central instrument section of ICI's head office in London 12 years ago

Commercial News

Aspro-Nicholas

Following discussions between the boards of Aspro-Nicholas and Clinical and General Industries, it has been agreed that Aspro-Nicholas will acquire from Clinical and General their holdings in Clinical Products Ltd. The consideration is the issue of 120,000 Ordinary 5s units in Aspro-Nicholas and the payment of about £127,000 in cash. In all the deal involves some £247,000.

The transaction is subject to Treasury consent and the approval of the shareholders of Clinical and General.

Birlec-Efco

Birlec Ltd., Tyburn Road, Birmingham 24, and Efco Ltd., electric furnace manufacturers, announce that negotiations between them for the formation of a new company, to take over certain sections of their business, have reached an advanced stage. The new company will be called Birlec-Efco (Melting) Ltd., and will have offices at Aldridge, Staffs.

The intended scope of the company is the design and supply of all types of electric melting furnaces for the ferrous and non-ferrous metals industries, together with smelting furnaces and induction heating equipment. Personnel will be drawn from the appropriate divisions of Birlec and Efco, thus combining in one organisation the specialist techniques and extensive experience of both companies.

Lawes Chemical Co.

In our issue of 20 September we erroneously stated in one of the headlines of the 'Commercial News' feature (p. 494) that the Lawes Chemical Co. had cut their dividend on lower profits. In fact, as correctly stated in the text, their dividend was increased from 12½ to 14 per cent. We regret this error.

ICI-Ilford Link

Under the agreement between Imperial Chemical Industries Ltd. and Ilford Ltd., reported in CHEMICAL AGE, 30 August, p. 367, ICI are to transfer to Ilford all scientific, technical and production data relating to colour photographic products. Ilford will also have the right to acquire from ICI such of the company's colour photographic production assets as Ilford may wish to acquire on terms to be agreed.

ICI will for at least 10 years carry out at cost on behalf of Ilford organic chemical research programmes for use in colour photographic products and processes. Ilford will fix the amount of annual research expenditure but research programmes will be determined by agreement.

Royalties to be paid by Ilford to ICI on their future sales of colour photographic products will not exceed a maximum of £350,000.

As already announced, ICI are to subscribe in cash at 15s each, 6.4 million

- Aspro to Acquire Clinical Products Ltd.
- Birlec-Efco Tie-up on Melting Furnaces
- ICI-Ilford's 10-Year Research Link
- Lawes Dividend was Raised, not Lowered

Ilford 5s shares. Initial payment will be 3s per share (1s nominal value and 2s premium). Future calls will be made as required by Ilford over the next five years. ICI will thus have 32 per cent of the Ilford equity. The new shares will not rank for any dividend to 31 October: ICI intend to hold them as a long-term investment.

Recommending the proposals, Ilford state that the capital requirements over the next five years are 'very substantial' apart from the field of colour photography. Shareholders are warned not to expect that 'spectacular' results will materialise immediately. Turnover for the current year is stated to have been well maintained despite increasing competition. But with the decline in profit margins, it is reported that profits this year will not reach the 1957 peak and cover for the 16 per cent ordinary dividend will be reduced below last year's 2.8 times.

Negretti and Zambra

Negretti and Zambra Ltd. are acquiring the whole of the share capital of New Western (Engineering) Ltd., Leeds, who have recently completed the extensions to Calder Hall and who have the contracts for the instrumentation for the four reactors at Chapel Cross.

The activities of New Western will continue as before including the manufacture of instrument panels and cubicles. They will also expand their facilities for both light and heavy fabrications to meet the growing demands for quality products. In addition the firm, which will be known as New Western (Negretti) Ltd., will include the design engineering of instrument projects. They will also expand their facilities for both works and site instrument erection.

The activities at present centred in Leeds will be duplicated in Aylesbury where a modern factory has been obtained. Management will remain unchanged, under the managing directorship of Mr. S. G. Lockley.

Power-Gas Corporation

Interim dividend of 5 per cent (same) has been declared by the Power-Gas Corporation. Total payment last year was 15 per cent.

Powell Duffryn

Powell Duffryn Carbon Products were affected by the credit squeeze during the year ended 31 March and the more cautious approach to projects involving capital expenditure, said Sir Henry Wilson Smith, chairman of Powell Duffryn Ltd., in his annual statement. Sales of Delanium plant for the chemical engineering

industry had remained more or less stable. Development projects included the use of graphite in the nuclear energy sphere and these had opened up interesting possibilities apart from the machining of graphite for the General Electric Co. Professor J. M. Kay, head of the nuclear energy department of Imperial College, had been retained as a consultant to the Powell Duffryn group.

Reichhold Chemicals Ltd.

Reichhold Chemicals Ltd. have declared an interim on ordinary in respect of 1958 at the rate of 7½ per cent equal to 4½d per 5s share, less tax. This will be payable on 10 October.

Vitamins Group

Group net profit of Vitamins Ltd., Upper Mall, London, for the year ended 31 March was £146,161 (£90,409). Net dividend is up from 17½ per cent to 20 per cent on capital increased by a 1 in 2 issue.

In his annual statement, Mr. H. C. H. Graves, chairman, refers to rising costs of the National Health Service, stating that of every £ of increased costs, the drug manufacturer has had 1s 10½d. Of the nine-year increase of £301 million in NHS cost, hospitals were responsible for £202 million, drug manufacturers for £28 million.

Humglas to Build Oil-gas Plant for Japan

A CONTRACT has been awarded to Humphreys and Glasgow to engineer and build a plant at Yaizu, Japan, to make town gas from heavy oil by the Onia-Gegi process. The plant, the first of its kind in Japan, has been ordered by the Tokai Gas Co. It will comprise one unit of regenerative Onia-Gegi plant, with ancillary plant.

The plant is scheduled to be in operation to meet the 1959 winter load. It will produce 500,000 cu. ft. of gas a day. A second unit is planned for 1960, when Onia-Gegi plant will become the only gas-making plant on the works.

Incorporated Plant Engineers Move

Headquarters of the Institution of Incorporated Plant Engineers has been moved from Solihull, Warwickshire, to 2 Grosvenor Gardens, London SW1, in order to provide a more central meeting place for a membership that is now world wide. Total membership has risen from 120 at the end of 1946—the year the institute was incorporated—to nearly 4,000 today. There are 18 branches.

TRADE NOTES

'SP' Rubber

Further data concerning the curing of compounds of Superior Processing rubber is published by the Natural Rubber Development Board in an additional information sheet A, an addendum to the BRPRA Technical Bulletin No. 2.

Production of SP rubber in the three first-quality grades—ribbed smoked sheet, crepe, and air-dried sheet—is expanding steadily. It is used either in place of or in conjunction with normal grades of natural rubber in high-grade compounds for extrusion or calendaring, permitting better control of dimensions, smoother surfaces and less liability to collapse in extruded sections.

Geigy Cut TXP Price

The Geigy Co. Ltd., Rhodes, Middleton, Winchester, have reduced the price of tri-xylyl phosphate (TXP) by £15 per ton. New prices for this product range from £201 per ton for 10-ton tanker deliveries to £211 per ton for single 40-gall. drum deliveries. The price of TXP, now 3d per lb. less than that of tri-tolyl phosphate (TTP), is said to be the cheapest primary plasticiser for p.v.c. made in the UK.

Booklet on PTFE

Crane Packing Ltd., Slough, one of the first companies in this country to process and fabricate p.t.f.e., have recently published a 26-page booklet describing this material. Contents include: processing of the basic raw material, moulding and extrusion, raw material forms, properties, material grades and their applications, p.t.f.e. components, dispersion coatings, the Bellows pump, the Fluoseal, 'O' rings, etc.

Vacuum Fusion Gas Analyser

Wild-Barfield Electric Furnaces Ltd., Watford, announce that the NRC Type 912 vacuum fusion gas analyser for the determination of oxygen, nitrogen and hydrogen in metals, is now available as a British-built unit. Because of the ability of type 912 to analyse very small samples, only a 3.5 kW induction heating generator is employed. A demonstration equipment has been installed at Elecfurn Works, Watford, where by appointment complete analyses may be seen.

KDG Instruments

K.D.G. Instruments Ltd., of Manor Royal, Crawley, Sussex, have opened a London sales and service office and showroom at 100 Fleet Street, EC4, telephone Fleet Street 5354.

Oil Burning Equipment

Stordy Engineering Ltd., Cumbria House, Goldthorn Hill, Wolverhampton, are now able to provide the complete range of Hauck designed fully proportioning oil burners, with ancillary equipment which has been developed by the Hauck Organisation of America. The Stordy Organisation holds a licence for manufacturing the range of Hauck combustion equipment. The range includes: Hauck micro cam oil valve, self-clean

metering oil valve, proportioning oil burner, combination proportioning oil and gas burners, radiant tube burners (for oil or gas), radiant tube gas burners.

Engelhard Industries

Engelhard Industries Ltd. will be holding a private exhibition of the products of their Baker Platinum and Hanovia Lamps Divisions at the Midlands Electricity Board's Industrial Showroom, 247 Chester Street, Aston, Birmingham 6, from 29 September to 10 October (not Saturday or Sunday). Opening hours will be 10 a.m. to 12 noon and 2 to 4.30 p.m.

Changes of Address

From 1 October the address of Mr. Robert H. S. Robertson, consultant in raw material development, and Resource Use Ltd., will be 'Dunmore', Pitlochry, K. W. Chemicals Ltd., are moving to new offices on 6 October at 55-57 High Holborn, London WC1 (Chancery 7981).

The British Bureau of Non-Ferrous Metal Statistics has moved to 6 Vicarage Road, Birmingham 15. Telephone number is unchanged at Edgbaston 3886.

Platinum Prices Reduced

Platinum prices have been lowered by £2 to £21 5s per troy ounce by the UK platinum refineries, Baker Platinum and Johnson Matthey. This is the fourth reduction in platinum prices this year. In January the price was £28 10s per troy ounce. The last reduction was made in July. On the open market, platinum, largely supplied by Russia, is currently quoted at £19 to £20 per troy ounce.

Changes to CA List of British Chemical Prices

The following are price changes recorded in the past month. The full CHEMICAL AGE table of British Chemical Prices was published in our issue of 26 July, p. 164.

Copper Carbonate. Per lb., 2s 6d.
Copper Sulphate. F.o.b., less 2% in 2-cwt. bags, £72 10s.

Glycerine. Chem. pure, double distilled 1.2627 s.g. per cwt., in 5-cwt. drums for annual purchases, of over 5-ton lots and under 25 tons, £10 1s 6d. Refined technical grade industrial, 5s per cwt. less than chem. pure.

Iodine. Resublimed BP, under 1 cwt., per lb., 14s 1d; for 1 cwt. lots, per lb., 13s 2d. 5 cwt. per lb., 12s 8d.

Iodoform. Under 1 cwt., per lb., £1 2s 4d, for 1 cwt. lots, per lb., £1 1s 8d, 5 cwt. per lb., £1 1s 1d, Crystals 3s more.

Salicylic acid. Manchester: Tech., d/d, per lb., 2s 6d, 1 ton lots, £20 10s.

Sodium Iodide. BP, under 1 cwt., per lb., 13s; 1 cwt. lots, per lb., 12s 9d. 5 cwt. per lb., 12/3.

Tartaric Acid. Per cwt.: 10 cwt. or more, £14 10s; 1 cwt., £14 5s.

Zinc Oxide. Max. for 2 ton lots, d/d, white seal, £92; green seal, £90; red seal, £87.

Dioctyl Phthalate. In drums, 10 tons, d/d, per ton, £284, 45 gall. drums, d/d, per ton, £290.

Carbon Black. UKARB 327-7½ lb, ex works, 3 ton lots.

Carbolic Acid. Crystals, min. price, d/d bulk, per lb., 1s 4d; 40/50 gall. ret. drums extra, per lb., 1d.

Crude 60's, per gall. 8s 4d. Manchester: Crystals, d/d, per lb., 1s 4d-1s 7d; crude, naked, at works, 8s 5d.

Xylole. According to grade in 1,000 gal. lots, d/d London area in bulk, per gall., 6s 2d-6s 5d.

Market Reports

Moderate New Business

LONDON Prices continue steady in virtually all sections of the chemicals market. New business on home account, although fairly widespread, is again moderate in volume, while the chief industrial outlets are taking good deliveries against contracts.

Apart from the routine potash and soda products, there has been an active demand for hydrogen peroxide, borax, boric acid, arsenic and formaldehyde. Pitch is fairly active among the coal-tar products, whilst creosote oil and the xyloles are attracting interest.

MANCHESTER While most industrial users of chemicals, with the exception of the textile trade, are calling for reasonably steady deliveries of heavy chemicals against contracts, new home-trade commitments on the Manchester market continue to be over shorter periods in most instances than has been the experience for some time. Export business, although less active, is on a fair scale. Prices generally have been maintained. In the fertiliser trade buying is limited to a relatively few sections.

GLASGOW No significant change took place during the past week in the Scottish heavy chemical market. Business generally remained quiet, although towards the end of the week some improvement was noted. Demands were mostly for immediate delivery, with quantities reasonably well maintained. Prices showed little change with a tendency to firmness. Agricultural chemicals remain seasonably quiet.

Synthetic Organic Chemicals Added To KID List

THE Safeguarding of Industries (Further Supplementary List of Synthetic Organic Chemicals etc.) Order, 1958, introduces a supplementary list ('KID List K') of synthetic organic chemicals, etc., which are liable to Key Industry Duty. The Order, which comes into operation on 27 September, is SI No. 1584, and can be obtained from HM Stationery Office, Kingsway, London WC2 and branches on 26 September, price 3d, by post 5d.

3-Amino-1-(2:4:6-trichlorophenyl) pyrazol-5-one; amisonitrilic acid; azoformamide; tribarium dipyrrolic acid phosphate; (benzothiazol-2-ylthio) acetic acid; o-bromo-o-ethyl-n-butyl-p-phenetide; o-bromoisovalero-p-phenetide; p-tert-butyl-cyclohexanol; calcium nicotinate; 8-mono-chloro-propionic acid; chlorothiazide; cyclohexanone peroxide.

4:4'-Diamino-3:3'-dichlorodiphenylmethane; 2:5-diteramyl quinol; 1:3-dibromo-5:5-dimethylhydantoin; 4:7-dichloroquinoline; di-n-dodecylamine; dimethyldiamine; N-n-dodecyl dimethylamine; 2-hydroxy-4:6-dimethylpyrimidine; NN'-di (p-nitrophenyl) urea; di-n-octadecylamine; diphenylhydrazine; diisopropylxanthogen disulphide. Ethyleneurea; florantycrone; n-hexadecylamine; n-hexadecylammonium acetate; o-2-hydroxyethylaminophenol; o-2-hydroxyethylaminophenol hydrochloride; 2-hydroxyethylhydrazine; NN'-di (p-nitrophenyl) urea 2-hydroxy-4:6-dimethylpyrimidine complex.

1:2:2:6:6-pentamethylpiperidine hydrogen tartrate; 5-phenylhydantoin; propionethine bromide; quinoline-8-sulphonic acid; theophyllin-7-ylacetic acid; 2:4:6-trimethylpiperidine; tri-n-propyltin acetate; tri-n-propyltin chloride; tri-n-propyltin laurate; di-(tri-n-propyltin) oxide; vitamin A (synthetic) and its acetate and palmitate.

NEW PATENTS

By permission of the Controller, HM Stationery Office, the following extracts are reproduced from the 'Official Journal (Patents)', which is available from the Patent Office (Sale Branch), 25 Southampton Buildings, Chancery Lane, London WC2, price 3s 3d including postage; annual subscription £8 2s.

Specifications filed in connection with the acceptances in the following list will be open to public inspection on the dates shown. Opposition to the grant of a patent on any of the applications listed may be lodged by filing patents form 12 at any time within the prescribed period.

ACCEPTANCES

Open to Public Inspection 5 November

Compounds of uranium and their utilisation in energy-producing devices. Hollins, C., and Appleton, E. V. **804 062**
 Method for production of uranium. Imperial Chemical Industries, Ltd., Cooke, W. H., and Crawford, J. W. C. **804 063 & 804 064**
 Production and working of refractory metals. Imperial Chemical Industries, Ltd., Cooke, W. H., and Crawford, J. W. C. **804 065**
 Sublimation process and apparatus. Krohn, R., and Schmidt, R. J. **803 989**
 Anodic treatment of uranium metal. UK Atomic Energy Authority. **803 990**
 Rubber compositions. Dunlop Rubber Co., Ltd. **803 993**
 Washers for sealing joints in pipes conveying aromatic hydrocarbons. Pneumatiques et Caoutchouc Manufacture Kleber-Colombes. **803 997**
 Dehydrogenation of alcohols. Knapsack-Griesheim A.G. **804 132**
 Purification of polyethylene. Ruhrchemie A.G. **804 072**
 Bicyclononanol and ethers thereof and a composition of matter with a woody amber-like scent, and process of making same. Firmenich, A., Firmenich, R., Firmenich, G., and Firmenich, R. [trading as Firmenich & Co.] **804 051**
 Stable dispersions of oxides of metals and/or metalloids. Deutsche Gold- und Silber-Scheideanstalt Vorm. Roessler. **804 140**
 Lubricant for the surface of an insulated wire. General Electric Co. **804 112**
 Continuous bleaching of textile fabrics made from vegetable fibres. Imperial Chemical Industries, Ltd. **803 796**
 Production of amines. Imperial Chemical Industries, Ltd. [Addition to 712 100.] **804 113**
 Process for the refinement of fatty acid esters. Nobile & Thoerl G.m.b.H. **804 022**
 Sulphonamidophosphoric esters. Olin Mathieson Chemical Corp. **804 052**
 Anion-exchange resins. Permutit Co., Ltd. **804 066**
 Lactic acid derivatives and process for the preparation thereof. Boehringer, A., Boehringer, E., Liebrecht, I., Liebrecht, J., and List, W. Mayer- [trading as Boehringer Sohn, C. H.] **804 117**
 Treatment of anion-exchange resins. National Research Development Corp. **804 074**
 Production of cross-linked elastomers. Farbenfabriken Bayer A.G. **804 067**
 Preparation of an elastic polyurethane composition. Lemförder Metallwarengesellschaft. **804 025**

Polysiloxanes. Rohm & Hass Co. **804 119**
 Semiconductor comprising silicon and method of making it. Standard Telephones & Cables, Ltd. **803 836**
 Preventing corrosion in the cooling system of an internal-combustion engine. Farbenfabriken Bayer A. G. **803 832**
 Granular fertilisers. Scottish Agricultural Industries, Ltd., and Imperial Chemical Industries, Ltd. **804 053**
 Alkyl phenols. Institut Français du Pétrole, des Carburants et Lubrifiants. **804 121**
 Esters of cyclic amino-alcohols. Lakeside Laboratories, Inc. **804 123**
 Method for the treatment of hair and dithiocarbamate derivatives therefor. Van Ameringen-Haebler, Inc. [Addition to 771 627] **804 077**
 Production of hydrocarbon polymers. Monsanto Chemical Co. **804 079**
 Filaments of high density, high molecular weight ethylene polymers and method of making such filaments. Dow Chemical Co. **804 054**
 Thiochromones and thioxanthones. Farbenfabriken Bayer A.G. **803 803**
 Vinylphosphoric acid ester. Farbenfabriken Bayer A.G. **804 080**
 Preparation of urea-formaldehyde moulding powders. Soc. Belge de l'Azote et des Produits Chimiques du Marly. **804 055**
 Substance having antioxidant activity and its preparation from yeast. Pennsylvania, Trustees of the University of. **803 898**
 Production of organosilicon compounds. Midland Silicones, Ltd. **804 097**
 Derivatives of 4-hydroxycoumarin and their production. Farbenfabriken Bayer A.G. **804 125**
 Working up low pressure polyolefines. Chemische Werke Hülls A.G. **804 081**
 Esters and vinyl chloride polymer compositions containing same. Monsanto Chemical Co. **804 057**
 Glass compositions. Pittsburgh Plate Glass Co. **804 106, 803 927 & 803 928**
 Process for preparing fluorosilanes. Grace & Co., W. R. **804 068**
 Improving the transparency of polyolefines. Chemische Werke Hülls A. G. **804 058**
 Preparation of aromatic nitriles and imides. Distillers Co., Ltd. **803 901**
 Germicides. Monsanto Chemicals, Ltd. **804 047**
 Copolymers of vinyl acetate and fumarate. Esso Research & Engineering Co. **804 029**
 Aqueous colloidal dispersions. Dow Chemical Co. **804 030**
 Drying apparatus. American Cyanamid Co. **803 094**
 Flameless combustion of organic substances. Helberger, J. H. **803 929**
 Polymeric compounds and products containing same. Du Pont de Nemours & Co., E. I. **804 069**
 Removal of metal contaminants from polymers. Esso Research & Engineering Co. **804 082**
 Production of alkyl alkoxy aluminium halides, alkyl aryloxy aluminium halides, and alkyl aluminium dihalides. Badische Anilin- & Soda-Fabrik A.G. **804 059**
 Polymerisable silane derivatives and method for producing same. Union Carbide Corp. **803 961**
 Copolymerisation of diolefines and alpha-olefines. Chemische Werke Hülls A. G. **804 083**
 Therapeutic compositions. Warner-Lambert Pharmaceutical Co. [Addition to 771 768 and 793 379.] **804 084**
 Lubricating oil containing polypropylene. Esso Research & Engineering Co. **804 085**
 Phthalocyanine pigments. General Aniline & Film Corp. **804 031**
 Dyeing textile materials with dyestuff emulsions. Badische Anilin- & Soda-Fabrik A.G. **804 032**
 Manufacture of regenerated cellulose sponge material. General Mills, Inc. **804 126**

Derivatives of leucauramine. National Cash Register Co. **804 087**
 Preparation of cyclohexenone derivatives. Soc. des Usines Chimiques Rhone-Poulenc **804 089**
 Joining glass articles and composition therefor. Corning Glass Works. **803 963**
 Electrolytic production of iron powder. Soc. d'Electro-Chimie, d'Electro-Metallurgie et des Acieries Electriques d'Ugine **803 844**
 Production of unsaturated hydrocarbons. Chemische Werke Hülls A.G. [Addition to 792 604.] **804 090**
 Production of aluminium powder. Norddeutsche Affinerie. **803 908**
 Disazo pigments and their use. Geigy A.G., J. R. **803 985**
 Manufacture of a sulphanilamide of the isoxazole series. Hoffmann-La Roche & Co. A.G., F. **804 036**
 Organopolysiloxane resin. General Electric Co. **803 845**
 Copper-containing trisazo dyestuffs. Farbenfabriken Bayer A.G. **803 810**
 Cyclosiloxanes. Midland Silicones, Ltd. **804 098**
 Niobium alloys. Du Pont de Nemours & Co., E. I. **803 855 & 803 937**
 Cellulosic product. Kimberly-Clark Corp. **803 987**
 Recovery of pure dimethyl terephthalate. Badische Anilin- & Soda-Fabrik A.G. **803 849**
 Dimerisation of polypropylenes. Esso Research & Engineering Co. **804 070**

DIARY DATES

WEDNESDAY, 1 OCTOBER

Nat. Soc. for Clean Air—Llandudno, Pier Pavilion. Annual Conference. Until 3 October.
 RIC—London: Wimbledon Park Golf Club, SW19, 9 a.m. Autumn golf meeting.
 RIC—London: Eltham College, Grove Park Road, SE9, 7.30 p.m. Careers in chemistry.
 SAC—London: Royal Institution, 21 Albemarle Street, W1, 6.30 p.m. 'Report on use of radiochemical methods to investigate recovery of trace elements from organic materials,' by T. T. Gorsuch.
 Soc. for Water Treatment & Examination—Leicester: Beaumont Hall, University. Autumn meeting. Until 3 October.
 SCI—London: 14 Belgrave Square, SW1, 6.30 p.m. 'Corrosion embrittlement: the effect of cathodically evolved hydrogen on iron and nickel,' by M. Smialowski.

THURSDAY, 2 OCTOBER

Inc. Plant Engineers—Southampton: Polygon Hotel, 7.30 p.m. 'Safety precautions,' Discussions on 'Safety precautions' and 'Preventative maintenance.'
 Plastics Inst.—Southampton: Chemistry Dept., University, 7.30 p.m. 'Processing, properties & applications of Ziegler polyethylenes,' by S. Squires.
 Polarographic Soc.—London: Duke of York, 8 Dering Street, W1, 7 p.m. 'Polarographic problems in the nylon industry,' by R. D. Middleton.
 Purchasing Officers' Assoc.—Southport: Cambridge Hall, for conference; Atkinson Art Gallery, for Minibition. Both until 4 October.
 SCI—London: 14 Belgrave Square, SW1, 6.15 p.m. Physical methods in microbiology.

FRIDAY, 3 OCTOBER

Plastics Inst.—Manchester: Textile Inst., Blackfriars Street, 6.45 p.m. 'Polyester glass fibre moulding by matched metal moulding method,' by H. R. Everard.
 SCI—London: 14 Belgrave Square, SW1, 6.30 p.m. 'Cortisone from hecogenin,' by Dr. B. A. Hems.

SATURDAY, 4 OCTOBER

SAC—Liverpool: City Laboratories, Mount Pleasant, 2.15 p.m. Discussion on 'Laboratory balances'.



"VULCAN" IRON AND STEEL CARBOY HAMPERS
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